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COMPREHENSIVE WATER POLLUTION CONTROL PLANNING

Pacific Northwest Water Laboratory
Corvallis, Oregon

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COMPREHENSIVE WATER POLLUTION CONTROL PLANNING

Proceedings of the Thirteenth Pacific Northwest Symposium on Water Pollution Research

APRIL 14, 1965

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of State Services
Division of Water Supply and Pollution Control

PACIFIC NORTHWEST WATER LABORATORY
CORVALLIS, OREGON

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FOREWORD

This symposium on Comprehensive Water Pollution Control Planning is the thirteenth such meeting arranged as a part of the water pollution control activities of the Public Health Service, U. S. Department of Health, Education, and Welfare, in the Pacific Northwest. The series of meetings was initiated in 1957 through the vision and efforts of the late Edward F. Eldridge, Public Health Service Technical and Research Consultant, at Portland.

These symposia will be continued now as a program element of the Pacific Northwest Water Laboratory. We are confident this approach to examining water problems, the tools available to solve them, and the research needs now apparent will continue to be fruitful.

CURTISS M. EVERTS, Director
Pacific Northwest Water Laboratory

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WELCOME

M. Popovich
Dean of Administration
Oregon State University
Corvallis, Oregon

It is a pleasure and a privilege to welcome conferees of the Comprehensive Water Pollution Control Planning Symposium to the campus of Oregon State University.

I believe most of you know that staff members of Oregon State University pioneered water pollution studies in this part of the country more than 30 years ago. The early publications of the Engineering Experiment Station were dominated by reports of these studies. I think it is especially appropriate that two speakers on the program, Professor Fred Merryfield and Dean George Gleeson, are two of the pioneers who worked together surveying the Willamette River. Some of you will recall that these gentlemen documented the deplorable condition of the Willamette and have been very instrumental in a long and continuing effort to restore it to some semblance of a purified stream.

In more recent years, the Public Health Service has been a strong and welcome force in helping the State solve its worst pollution problems, but I don't have to tell you that there is still a long way to go. These symposia, and others like them that have been held here, have served very well to keep the major problems in focus. One conclusion has been most evident during the water pollution control studies that have been made during these past 30 years, and that is, additional problems arise about as rapidly as old ones are solved--maybe even a little more rapidly.

Water resources have been a major concern of this institution of Oregon State University for a long time, and we were absolutely elated to have the Public Health Service decide to build the Pacific Northwest Water Laboratory on our campus. We now have confidence that the concentration of technical talent here in Corvallis will begin to solve the pollution problems more rapidly than the new ones come along. We look forward to the material strengthening of our long-standing cooperative effort under the leadership of Cy Everts and his excellent staff. I am certain this, the thirteenth symposium, will be informative and as profitable as the twelve that have preceded it.

INTRODUCTION

Curtiss M. Everts, Director
Pacific Northwest Water Laboratory
Division of Water Supply and Pollution Control
Public Health Service
U. S. Department of Health, Education, and Welfare
Corvallis, Oregon

I would like to extend to each of you a very cordial welcome to this 13th Symposium on "Comprehensive Water Pollution Control Planning."

At each of the symposia in this series it has been customary for someone to set the stage for the presentations and the discussions to follow. In the past this task was always skillfully performed by the late Edward F. Eldridge, who was our Technical and Research Consultant in Portland for many years. It was through his initiative and foresight that men and women of science, industry, and government have been able to join in an exploration of water pollution control research problems during these past eight years. We shall always be indebted to him for his part in this knowledge-sharing experience. During these intervening years, the water problems examined have covered a wide range, involving marine and freshwater environments, toxicity problems, slime growths, heat pollution, radioactive wastes, and others. Certainly, notable research in these many areas has been stimulated as a result.

Beginning with the twelfth symposium on Water Temperature - Influences, Effects, and Control, held November 7, 1963, sponsoring these symposia has been adopted as a continuing program by the Pacific Northwest Water Laboratory. We are confident this partnership in examining water problems, the tools available to solve them, and the research needs now apparent will continue to be fruitful.

I sincerely hope that we can carry on the work that he so ably started and do so in a fashion that would have gained his nod of approval.

Water is such an important part of this nation's life that no one can afford to ignore the problems associated with its utilization, conservation, or management. The sportsman, the pleasure boat owner, the commercial fisherman, the manufacturer, the farmer, the housewife, and the elected official are keenly aware of the benefits that accrue from an abundant supply of clean water. They are also well aware of the fact that water suitable enough for their individual uses is not

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always readily available. This is a situation that can be attributed to a number of factors, chief among which are the fixed amount of water available, the increase in water consumption and a deterioration in water quality brought about by population, industry, and land use practices.

If we are to successfully solve this problem, we must do a much better job of planning for water management in the future. Our collective objective must be to deliver an adequate supply of water of acceptable quality at the place and at the time it is needed.

The preparation of such a plan is not an easy assignment. The complexities that arise through misunderstanding of needs, conflicts of interest over the quantity and quality of water for specific purposes, and in many instances the absence of technical knowledge are constant impediments to progress and accomplishment. These we must have the knowledge and patience to overcome.

There are several fundamental factors worthy of mention which affect the planning process for water resources in major river basins. First, it is unlikely that an acceptable plan will evolve from a number of unrelated programs that have been developed on a local or subregional basis. Second, in the preparation of a plan the frank and serious cooperation of each agency in its development is essential if the recommendations for water resource and water quality management are to be compatible. Third, there must be a reasonably good understanding of the objectives of the plan by all elements of government, by those whom the plan affects, and by those who will finance its undertaking. Fourth, the plan is of no value unless its authors and advocates have a firm desire to place it in operation and carry out recommendations they have collectively reached.

While comprehensive water pollution control planning is only one element involved in water resource management, it is an important one. Without water pollution control, the quality of water, which shares an equally important place with quantity, will be deficient to supply the demand, particularly in some regions where water must be used several times.

Today, this symposium brings together a team of men who have a broad knowledge in the area of water supply and pollution control planning. They represent a diversity of viewpoints and are well qualified to develop the subject and to comment on the implication that such planning may have on their particular area of interest. I sincerely hope that each of you will participate fully in the discussions. If there are areas that are in need of further research, investigation or data collection, I hope that they will be brought out in the open

today for all to examine. For it is only by a sincere discussion of these problems, what is being done about them, and what remains to be done that our efforts will be productive and our objectives be achieved.

COMPREHENSIVE WATER POLLUTION CONTROL PLANNING

Keith S. Krause, Chief
Technical Services Branch
Division of Water Supply and Pollution Control
Public Health Service
U. S. Department of Health, Education, and Welfare
Washington, D. C.

The past 50 years have witnessed a very dramatic growth in our population, in the number of cities, in the number and varieties of industries, and in water uses and volume. In 1900 the population of this country was about 75 million. Of this number, 39% lived in urban areas and used approximately 35 gallons per capita per day. Today about 70% of our 192 million people are urban dwellers and urban water use averages 150 gallons per person per day.

In 1900 there were about 950 communities in the United States with sewer systems. These served approximately 25 million persons. Today there are roughly 12,000 communities having sewer systems. The increase in number of industries has been even more phenomenal. This growth has inevitably placed the outfall of the sewer system closer and closer to the water intake of the industry or municipality, and the volume of water used and returned to the stream has been multiplied many times.

By the year 2000 our population may have reached nearly twice what it was even at the last census. Faced with this probability, it behooves us to examine our water policies and programs very carefully.

At this point in time it is very clear that if we do not move rapidly toward greatly increased attention to water quality control, the results may be that of curtailing our economic progress. A number of crises have developed during the past 10 years which warn us that we are definitely in a critical period and that we no longer can afford to proceed with pollution abatement without a carefully thought-out plan and program. We know that such a guide must be comprehensive, that its objective must be the production of water in quality and quantity which will not limit economic and social development. In other words, it must be good enough in quality and quantity to sustain continued present uses and attract new ones permitting economic expansion and providing for adequate public health protection at one and the same time.

We believe that the tools and the capabilities for developing such a blueprint or guide are now available and that such programs are possible.

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COMPREHENSIVE WATER POLLUTION CONTROL PLANNING

Effective water quality management can only be a river basin or watershed activity. We do not believe that a successful plan can evolve from any group of disconnected individual or subregional programs be they city, industry, or State. Quantity and quality of water are inseparable and if properly managed both are controllable factors which will permit the multiplication of uses indefinitely. We believe that quality control can be exerted most efficiently by removing as much of the pollutant as is practical as near the source as possible.

We are also aware of the technical limitations which prevent us from removing pollution from water. We are aware that treatment and removal capabilities at the present time are simply not good enough to provide the kind of water quality needed by the many kinds of users existing today, much less the potential future needs. We must, therefore, seek additional measures to supplement waste treatment or removal which will give us a degree of added protection when and where it is needed. Stream regulation is a practical measure which can be applied as a secondary line of defense against the inroads of pollution from treated residual wastes and those wastes not susceptible to treatment or removal.

The achievement of a water quality management program will permit most, if not all, uses of water to be sustained. Such management must be and now is part and parcel of the total water resource development program. It is compatible with National policy to develop the Nation's waterways for recreation, navigation, power, flood control, irrigation, municipal and industrial water supply, and fisheries.

In organizing for the preparation of the Public Health Service's comprehensive water quality management programs, we have, for the sake of economy and accountability, in terms of both work accomplishment and fiscal matters, adopted project-type organization. For each basin we are establishing a special group whose sole mission will be to undertake the necessary investigations described. We have divided the Nation into 20 major basins or areas which correspond closely with areas depicted on the U. S. Geological Survey water resources development map.

Each area will have a project team consisting of a project director together with an administrative staff capable of a high degree of self-sustenance in budgeting, purchasing, and personnel matters, a laboratory section, an engineering section, a data-processing storage and evaluation section, and a planning and reports section. Each project is attached to the appropriate one of our regional offices located in Boston; New York City; Charlottesville, Virginia; Atlanta; Chicago; Dallas; Denver; San Francisco; and Portland, Oregon. Top-level consultation on technical problems is provided from our Cincinnati Robert A. Taft Sanitary Engineering Center staff and general supervision, budget, and policy guidance are provided through the Technical Services

Branch of the Public Health Service's Division of Water Supply and Pollution Control in Washington, D. C. The Technical Services Branch is also directly responsible for the review and final approval of reports and plans emanating from the projects.

At the present time, projects are under way in the Arkansas-Red Basins, the Columbia River Basin, the Great Lakes-Illinois River Basins, the Delaware River Estuary, the Susquehanna-Chesapeake Bay, the Ohio River Basin, the Southeastern River Basins, and the Hudson-Champlain and Metropolitan Coastal area. Approximately 400 people are engaged in these operations, supported by a $7.0 million appropriation for FY 1965. Project personnel have diverse professional competencies and include chemists, biologists, bacteriologists, engineers, data analysts, computer programmers, planners, economists, demographers, physicists and others.

The comprehensive plan is the result of a number of fundamental steps. Our approach may be pictured as the convergence of two vectors. Vector "a" includes the investigations leading to a summary of information concerning the physical, chemical, and biological characteristics of the streams, lakes, and subsurface aquifers which have an effective role in a natural watershed.

We term this summarization a resume of waterways dynamics. It is a compilation of the waterway idiosyncracies which give that body personality, including a description of its behavior; for example, its volume in terms of frequency distribution, its response to pollution stimuli, its velocity of flow, its natural chemistry, its biology, and microbiology. It includes the amounts of water withdrawn, and the characteristics and amounts of used water returned. It includes all portions of the basin system receiving pollutants or likely to receive pollutants. This information can be expressed by a series of numerical values, ranges, statistical frequencies, probabilities, and locations. These values are representative of observations made in great varieties of frequency and location, gathered over a long enough period to make them statistically valid and broad enough in coverage to assure that no major environmental influences are left out. This is one of the fundamental aspects of the planning phase.

The second major vector is the summarization of the source economic and physical elements which can be recognized as having an influence on the future development of the area served by the waterway. This summary includes the economic resources, financial and other growth characteristics and opportunities. This summary is again represented by a series of values, rates, frequencies, probabilities, and locations which give dimension to this vector which we call the forecast dimension. It must include many assumptions such as the expected

and planned rates of expansion by area utilities such as gas, electric, water, and telephone; and forecasts by the financial interests, the banks, the Federal Reserve System, business and industry, forecasting interests, industrial management and urban planning experts.

These two elements form the basis, then, for preparing for the comprehensive water quality management plan. Another most important element must be brought into the picture at this point. What are the water quality goals to be achieved? An answer must be provided in terms of specific values and qualified as to time, place, and purpose. The Public Health Service, realizing that such goals are not uniform and may vary widely from river to river, is attempting to rationalize these goals by seeking user group opinions on the kind of water which should be supplied at given places in the stream system.

User groups are brought together first as separate committees. We assist these groups first by defining their job and in providing them information as to the effects of various kinds of pollutants on present and prospective water use. It appears to be working satisfactorily. Out of the thousands of possible use-quality parameters the groups may select certain indicators around which the plan can be developed. Once the water quality goals have been established, it is the planner's responsibility to use the water dynamics and the forecast information in setting up and simulating a system which would provide the water quality desired, using source control and such additional control as may be available in streamflow. He must then decide which of several possible alternatives would give the greatest efficiency and economy. This you will recognize as amenable to systems analysis techniques. These techniques will be employed extensively in our projects. We intend to carry the planning far enough to illustrate the quality of water which can be discharged, where sewer outfalls should be located to minimize pollution effects on downstream water uses, and what streamflow regulations will be required.

The project reports will contain: (1) estimates of quantity, location, and time that water uses will incur; (2) estimates of quantity, quality, location, and time of waste water returns to the streams; (3) summary of waste removal and treatment required in a time sequence to meet the water quality needs for water uses; (4) a summary of water quality goals for the enumerated water uses in terms of values and ranges for specific locations; (5) flow regulation required to supplement waste treatment and removal facilities, estimated by volume and location and in terms of chronological development; (6) a mathematical simulation of factors relating to water use, waste water hydrology, chemical and biological responses in the stream; (7) maps, charts, tables, and graphs depicting the orderly development of countermeasures needed to establish a predetermined quality of water at a given location

on or after a certain date insofar as that date is associated with a given population, industrial expansion, and other social and economic factors. The reports will go to Congress for such further consideration as may be called for. A major consideration in the development of a water quality management program must be the ways in which it can be implemented and operated. The sophistication of such a program requires definite and strong commitments from the participating parties to make it "work." It is patently clear that there can be no program for comprehensive water pollution control unless responsible parties are given the job of following through and making it work. A management group need not be a new creation, but it must be representative of the Federal, State, and local interests concerned with water pollution in a specific basin. The make-up of such groups will probably vary from one river basin to another. A management federation might derive its power to act from a highly formal arrangement between State and Federal governments as exemplified by the Delaware Basin Commission. On the other hand, it might act on the basis of the legal authorities residing in local, State, and Federal agencies bound together by agreements and commitments. In developing comprehensive water pollution control programs, one of the major efforts is to work out the arrangements and determine how the program will be implemented and operated.

Given time, patience and understanding, I believe we can move forward with water quality management in a planned manner so that crises which appear imminent will not occur.

Planning for the preservation and protection of the Nation's water resources is a must if we are to develop them in an economical, efficient fashion and avoid costly crash programs, conflicts between water use interests, and above all, provide enough good quality water to ensure continued good health and economic opportunities.

COLUMBIA RIVER BASIN
COMPREHENSIVE WATER POLLUTION CONTROL PROJECT

W. W. Towne, Director
Columbia River Basin Comprehensive Project
for Water Supply and Pollution Control
Public Health Service
U. S. Department of Health, Education, and Welfare
Portland, Oregon

I appreciate the opportunity to appear before you to discuss some problems which I feel are so vital to the economy of this region and the welfare of its people. I would like to thank Mr. Everts and his staff for developing a symposium devoted to comprehensive planning for water pollution control.

Mr. Krause has discussed the development of comprehensive water pollution control programs at the national level and has indicated that one of the several studies now under way is here in the Pacific Northwest. He has described the basic elements of these programs and the importance of water quality control in the development of the water and related land resources of the Nation.

In the next few minutes I will attempt to describe briefly some of the more important water quality problems, present and future, here in the Pacific Northwest, together with some of the factors to be considered in developing the water resources to achieve the greatest good for the greatest number for the longest time, a conservation goal expounded by President Theodore Roosevelt more than sixty years ago.

Water, as found in nature, always contains impurities. Unfortunately, both the type and concentration of these impurities increase as man puts water to his beneficial uses. Any such impurity is a pollutant when it becomes objectionable or interferes with other essential uses of water. These pollutants may be physical, biological, or chemical; and they may come from man-made or natural sources. In this context, therefore, water pollution control and water quality control are synonymous terms.

Fortunately, in contrast with many other parts of the Nation, the waters of the Pacific Northwest have not yet been seriously degraded except in a relatively few instances. Because of this fact, the people of this region still have it within their power to chart a course in resource development that will minimize the conflicts in achieving this goal. Once pollution has occurred, it is difficult--and frequently economically impossible--to restore water quality to

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that level that could have been maintained by the application of appropriate and feasible preventive measures.

One of our primary tasks, therefore, is to devise a plan of preventive action to protect the present high water quality which is so vital to the economic development of the region. This has resulted in a planning approach which sets water quality objectives as high as possible. To do less would only be an invitation to downgrade existing water quality. This does not imply a policy of clean water and no jobs but, rather, a policy of more jobs with clean water.

Section 2 of the Federal Water Pollution Control Act directs the Secretary of the Department of Health, Education, and Welfare to develop comprehensive programs for eliminating or reducing pollution of interstate waters and tributaries thereof; for improving and conserving such waters for public water supply, propagation of fish and aquatic life; and for industrial and other legitimate uses. These programs are to be developed in cooperation with other Federal agencies, state water pollution control agencies, interstate agencies, and municipalities and industries involved.

The question is often asked, "What is a comprehensive pollution control plan?" Briefly, this may be defined as follows:

A comprehensive water pollution control program is a systematic plan and implementation of means and measures of controlling water pollution and preventing pollutants from interfering with the legitimate water uses throughout a river basin. Comprehensive water pollution control programs must include, for each river basin: (1) population and industrial expansion forecasts, (2) hydrologic data and interpretive material, (3) accurate determination of stream and lake physical and biological characteristics, (4) trends in volumes of water used and returned to waterways as waste over the period of planning (50 years), (5) projection of treatment and waste removal needs for the planning period, (6) computation of streamflow requirements to reduce concentrations of pollutants which cannot be removed or treated adequately at the source, and (7) estimates of timing and costs of implementing the control and prevention planned. A fully developed program will provide guidelines for Federal, state and local regulatory and construction agencies to follow for meeting preset goals of water quality which will permit all legitimate uses.

Section 2(b) of the Act requires that consideration be given to the inclusion of storage for the regulation of streamflow for the purpose of water quality control in the reservoirs being constructed by the Corps of Engineers, the Bureau of Reclamation, and other Federal agencies. The Act directs the Secretary of the Department of

Health, Education, and Welfare to advise these agencies on the need for and value of storage for this purpose. This provision makes water quality control a full partner in river basin planning and development.

It should be pointed out that Congress has stipulated that storage in Federal reservoirs will not be provided as a substitute for adequate treatment or other methods of controlling wastes at the source. Consequently, the determination must be made as to what constitutes "adequate" treatment. For domestic sewage and those wastes which can be treated by the so-called conventional treatment processes involving biological oxidation, an average reduction of 85% of the organic matter contained in the raw wastes is considered to constitute adequate treatment. For many industrial pollutants, however, we still have not developed effective and economical means of control. Therefore, to define "adequate treatment" it is necessary to evaluate each type of industry to determine what degree of waste reduction can reasonably be accomplished within the limits of our technical knowledge. Such a determination can be made only by working closely with the industries involved. We have already received valuable assistance from several industries and will look forward to similar assistance from others as our studies progress.

While streamflow regulation is primarily a second line of defense against residual wastes of conventional treatment plants, it is the first line of defense against pollution resulting from various land-use practices, storm water runoff from urban areas, and other sources of waste which cannot be collected and brought to a central point for treatment. In either case, this use of stored water may well fill the gap as an effective quality control measure until the science of waste treatment and other methods of control become more efficient and less costly. When that time comes, I am sure the water now stored for quality control will not want for takers.

As indicated earlier, the Pacific Northwest is blessed with a bountiful supply of high quality water. There are some hot-spots, however, where water quality has been degraded as a result of man's activities and where water uses are damaged.

One of the important water uses in the Pacific Northwest is the anadromous fishery. Many streams once supporting a good population of these fish now are no longer productive. In some instances, this may be attributed to silting over of spawning areas, but probably the most important factors are increased water temperatures and decreased dissolved oxygen concentrations. The increased temperatures are not so much a result of thermal pollution as they are a reduction in streamflows, removal of vegetation which shaded the water and the

stream banks, and in some instances the warming of water by impoundment. Low dissolved oxygen is largely attributable to organic wastes from municipal and industrial sources and from some land-use practices. However, impoundments may also be responsible for reducing dissolved oxygen downstream from dams.

Impoundments have both beneficial and detrimental effects on water quality, especially during the summer months when streamflows are usually most critical. Temperature stratification which occurs in the reservoirs during this period is frequently accompanied by significant changes in the physical, chemical, and biological quality. The deeper waters are much colder than either the stream waters entering the reservoir or the upper layers of the reservoir itself. These waters are also frequently devoid of oxygen. Releases from reservoirs are invariably from the lower levels. If the water is released from these depths for the purpose of lowering downstream temperatures for fishery enhancement, a recognized beneficial water use in the Pacific Northwest, the fish may die because of lack of oxygen, thus defeating one of the anticipated beneficial uses. Here in the Pacific Northwest, where so many reservoirs have been built and so many are yet to be built, far too little attention has been given to the design and operation of such structures to minimize these potential conflicts. I should say, however, that our reservoir studies to date have shown that reservoirs fed from the relatively unpopulated watersheds have shown little or no oxygen depletion throughout the summer. This may be attributed to the minimum amount of organic matter to place a demand upon the dissolved oxygen, even though stratification does exist. Studies on Hungry Horse Reservoir in Montana and on the Detroit Lake Reservoir here in the Willamette Basin show little oxygen depletion at all depths. Brownlee Reservoir on the Snake River, however, is an entirely different picture. Here the reservoir waters are essentially completely depleted in dissolved oxygen below a depth of from 100 to 150 feet. The incoming waters in this case, however, are much higher in organic matter and support heavy algal growths, both of which may place a demand on the oxygen resources of the stored waters.

Because impounded waters usually provide a more favorable environment for the growth of algae, tastes and odors resulting from such organisms may be more prevalent and may cause trouble in treating public water supplies taking water from such sources.

In several places throughout the basin, recreational uses are frequently downgraded because of bacterial pollution, particularly immediately below some of the larger centers of population.

There are other types and sources of pollutants which in themselves appear quite insignificant, but which in the aggregate can and do exert significant effects on water quality and can damage other water uses. Storm water overflows from combined sewer systems can result in bypassing the major portion of the pollution directly to the streams during periods of storm runoff. Siltation from logging, road building, and certain farming practices, and the use of agricultural chemicals, fertilizers, and pesticides all pose potential pollution problems.

Many of the issues and problems encountered in water quality control, however, arise from the relationships existing between this function and other resource uses. The most serious conflicts arise between the in-stream, non-consumptive uses and the consumptive withdrawal uses.

The withdrawal of water for irrigation, for instance, has materially altered the historical hydrology of many of our streams throughout the Pacific Northwest, and particularly those lying east of the Cascade Mountains. Even where this use has not depleted the streamflow entirely, the allocated water rights frequently exceed the available natural flows in some months of every year. Some of these rights may not be exercised, but it is extremely difficult, if not impossible, to determine waste treatment needs and streamflow requirements for quality control without having a sound basis for design purposes. Assurance that flood water stored for quality control will be available for its authorized purpose is also essential.

The doctrine of prior appropriation and the use of water for irrigation are preeminent in the water policies and laws of all of the Western States. In many instances, however, we have found that such conflicts can be greatly reduced and water uses expanded through cooperative planning and intelligent management of available water resources without seriously jeopardizing prior rights. Water used for quality control at one location can frequently be available for reuse further downstream. Exchange of waters between different uses may also be another possibility for mutual gain. As the water resources of the basin become more completely utilized, the ability of the stream system to assimilate the used waters may be just as important as supplying water for its different uses. The Oregon State Water Resources Board has taken a forward step in eliminating much confusion in this area of water use by establishing minimum flows below which water rights cannot be exercised in those streams which are not now over-appropriated. Adjudication will be necessary to reserve this base flow where all flows are appropriated.

The use of water for hydropower generation can likewise impair water quality and affect downstream uses. While the average dry weather streamflows below power installations may be increased through storage, minimum flows are significantly lower and occur at much more frequent intervals. When hydropower is used for peaking purposes, this frequently results in cutting off essentially all the streamflow for short periods and can seriously endanger downstream water quality.

These and many other factors are being considered in the development of a comprehensive water pollution control program for the Pacific Northwest. To be effective, of course, such a plan must be implemented and the water resources of the area managed to accomplish the intended purposes. We fully realize that conflicts in water use will develop and there will be differences of opinion as to how they should be resolved. One of our principal objectives will be to present alternative actions, together with costs and benefits of each, which can serve as a guide to the people in arriving at the political and legislative decisions necessary for the development of the region.

Unlike the water resource development plans for the Corps of Engineers and the Bureau of Reclamation, which can be implemented directly by the agencies concerned following Congressional action, implementation of the water pollution control plan will depend on the action of a wide range of Federal, state and local agencies and industries, and the people concerned.

The Department's duties and responsibilities for implementation are spelled out in the Federal Water Pollution Control Act. These responsibilities include carrying out and encouraging intramural and extramural research, provision for grants to state water pollution control agencies to assist them in upgrading their activities, grants to municipalities and other political subdivisions to finance the construction of necessary treatment works, provision for personnel training in technical matters relating to prevention and control of water pollution, development of basic data relating to water quality and water pollution control, provision for technical assistance to state and interstate agencies and to municipalities and industries, Federal action to abate pollution of interstate or navigable waters within the limitations set forth in the Act, and making of recommendations for pollution control facilities at Federal installations. Each of these can play a significant role in a long-range water quality management program.

In the conduct of our studies here in the Pacific Northwest, we have developed certain tools that will be helpful in managing water quality and in predicting future needs as changing conditions may require. We have developed a computer program which will permit us

to predict the cause and effect relationships among waste loadings, streamflow, quality parameters, and flow regulation requirements. For example, by using dissolved oxygen as a quality parameter and by establishing a minimum concentration that can be tolerated in any stretch of the stream, we can predict streamflow requirements necessary to satisfy the dissolved oxygen objectives. If additional flows are required, it is possible to predict the storage requirements and the tributary or tributaries which can best supply the demand.

We are also developing a mathematical model to predict the temperature regimen of the streams within the basin. The interrelaship between temperature and dissolved oxygen in reservoirs will have to be fully considered.

We are also making use of mathematical models and systems analysis for evaluating the effects of pollutants in estuaries. Much less is known concerning the fate of pollutants in estuaries than in freshwater streams, and many more variables are involved. The use of computerized models can greatly reduce the laborious operations necessary to handle all of these variables.

Still another model is being developed; namely, a cost model which will permit a more accurate economic evaluation of a variety of alternatives of waste loadings, degrees of treatment, and water quality objectives.

All of these will become decision models in the implementation phases of the project.

Another useful tool that we have been using for the past two years is the continuous automatic monitoring of certain water quality parameters at fixed stream stations. Just two years ago we installed two such devices on the Willamette River, one above Oregon City and one on Swan Island in Portland Harbor. These machines measure and record four parameters; namely, temperature, dissolved oxygen, pH, and conductivity. This continuous surveillance has proven to be a valuable tool for use in areas where water quality conditions approach critical values or where water is in short supply. This can become a valuable management tool for advising appropriate authorities when to open the reservoir gates or to initiate extraordinary control measures to meet day-by-day situations.

With the development of comprehensive plans throughout the Nation, accompanied by the accumulation of large quantities of water quality data, it is apparent that a ready system of storage, retrieval, and analysis is essential if these data are to be most useful. Considerable time and effort have been expended in developing such a system by headquarters' personnel. As a result, there is now in operation a

system known as STORET, which is essentially an automatic library for storage and retrieval of water quality data. The system is open-ended so that data stations can be deleted or added at any time. Up to 100,000 water quality parameters can be coded and stored by STORET. Up to fifty selected parameters may be retrieved for five different stream configurations, and numerous statistical analyses can be performed on such data automatically. All information is punched on cards, read into the system, and stored on magnetic tape for later retrieval. Output can be obtained as a printed form which can easily be interpreted by a layman, or as magnetic tape which can be used as input to an analysis program that might be desired by the user. This system is just now getting operational in the Columbia Basin, and we will be able to include data from any and all reliable sources and identify its origin and other pertinent facts relative to the station. We feel that this will be a most useful tool not only to our operation but to other interested agencies.

As the need for water becomes more critical, these several management tools will increase in value. Making this service available to the water management agencies of the basin will be a continuing function of the Columbia River Basin Project.

In closing, I would like to reemphasize that the Pacific Northwest still has a lot of high quality water and that we are in the stage of resource development where wise planning, followed by wise decisions, can advance the economy of the area and the welfare of its people. Prevention will be less costly than correction.

USE AND ROLE OF WATER POLLUTION CONTROL PLAN BY OTHER FEDERAL AGENCIES

Robert L. McNeil, Staff Director
Columbia Basin Inter-Agency Committee
Portland, Oregon

Mr. Krause has described the National program in water pollution control, and Mr. Towne has brought this to a regional basis--what the project is for the Columbia Basin. My assignment, as I understand it, is to further delineate this by describing the way in which water pollution plans are to be coordinated with other Federal department planning activity. Mr. Towne asked me to do this because of the role which the Columbia Basin Inter-Agency Committee plays in coordination between the various Federal departments. It was his thought that one spokesman might be able to present a synopsis of the many, many Federal agencies' activities which relate to water pollution control and to discuss their coordination.

As a point of beginning, let me state the obvious, that planning as a process is conceived as an orderly way of going about achieving specific ends. Whether it be in our own personal lives or in building a major structure, and/or even to such intangibles as planning statements of policy, plans should lead to order. When it comes to water resources planning, it might be useful to recall that the provocation of planning often has been some extreme pressures, something cataclysmic, such as a major flood or a major drought. The nature of these kinds of stimuli can result in crash rather than orderly planning efforts. It seems to take either crushing natural phenomena or an accumulation of the debilitating acts of man to set a planning process in motion. This may, in part, account for the complex and diffuse authorizations under which Federal departments carry out planning. Congress has taken action in this way and that, and there has not always been a concern for the relatedness of one course of action as against another.

At a few periods in our history, we have taken time to look at our resources in an orderly fashion, and when we have done this, without the pressure of misfortune, orderly planning has resulted.

Several premises which I think are fundamental to water resources planning and coordination are:

a. Because a great many Federal agencies have some responsibility in water resources planning, and because responsibility is in many separate authorities and acts, there are many opportunities for

conflicts and duplication. (It wouldn't be difficult for me to list a number of examples to support this premise.)

b. It is worth noting that there is a very rapid increase in demand for land and water resources and that this competitive situation is a stimulus to current efforts to do a better job of planning. There is perhaps a sub-premise here, which is, that we deplore but tend to be provincial in our outlooks, concerned with what is of local importance, short-sighted and lacking in vision when trying to see the national interests and broader social and economic objectives of planning.

c. A third premise is that resources, science, and technology have been moving ahead at an accelerated but erratic pace. However, technical progress in one field has frequently led to problems in another--especially so in water pollution.

d. A fourth premise must be that, whereas, if our progress in science and technology is rapid, our progress in social, economic, and political understanding and action is erratic and slow.

What follows is: (1) a very brief mention of the Federal bureau interest in water pollution control planning, including a sampling of compatible and conflicting situations encountered; (2) a description of one of the coordination mechanisms in use in the Pacific Northwest; (3) a statement of what I think are some essentials to effective coordination; and (4) some challenges which, if accepted, could lead to more effective planning.

FEDERAL BUREAU INTEREST IN POLLUTION CONTROL PLANNING

Department of Agriculture

This Department's interest in water resources planning stems from organic acts dating from 1897.

The Soil Conservation Service, through its technical assistance program, provides many assists to farmers relevant to pollution control. Under Public Law 566 of 1954 it is able to assist in providing for water supply and water quality in local small multipurpose projects.

The Forest Service is committed to the production of high quality water from National Forests and is interested in local problems of pollution, management of National Forest watersheds which supply municipal water, and in maintaining and enhancing waterflows and in controlling sedimentation from forested headwaters.

Use and Role of WPC Plan by Other Federal Agencies

The Economic Research Service has responsibilities in making the economic analyses of water pollution which results from agricultural operations: for example, irrigation, the application of fertilizers, pesticides, and weedicides; and the problems of sedimentation which result from poorly-managed agricultural lands.

Department of the Army

This Department has been concerned with the problems of pollution for a long time. Within the Corps of Engineers structures, water releases for downstream flow augmentation have been provided for many years. The passage of Public Law 660 in 1956 added emphasis to Corps flow augmentation efforts.

The Corps has been engaged in comprehensive river basin planning for a long time, beginning with its early "308" reports. In these, preliminary notions of the problems of pollution began to come forth. Today, the Corps of Engineers looks to the U. S. Public Health Service to provide the basic information essential for pollution control and water supply planning within authorized projects. It is concerned with pollution control, not only in planning, but in construction and management of reservoirs in a balance among the water demands for irrigation, fish and wildlife, recreation, and power. Altogether, these present a complex problem.

Department of Health, Education, and Welfare

The interests of this Department, through its Public Health Service, stems from the Act of 1956, Public Law 660, and have been described nationally by Mr. Krause, and for the Columbia Basin by Mr. Towne. I picture the role of this Department in this respect as essentially that of a counselor. The Department includes competent technical people in the field of water pollution control. They do not specify to the Corps of Engineers or to the Bureau of Reclamation what the pollution control requirements are, but, rather, they counsel with them on what the alternatives are and provide a sound technical basis from which choices may be made. The Department of Health, Education, and Welfare's concern is not only biologic in nature, but also aesthetic.

Department of the Interior

This Department's first interest in water resources--hence, pollution control--planning began in 1879. The Department includes nine agencies which have authority for one aspect or another of water-related programs, many of which require the kinds of information available in a water pollution control plan.

The Bureau of Sport Fisheries and Wildlife is concerned with the maintenance of optimum natural waters for the biologic benefit of the sports fishery. It conducts research and is concerned with the relationship of water quality to the quality of fish, including such concerns as pesticides and toxicants which may enter the water. This Bureau works in close cooperation with the state fish and game agencies. The state agencies define the streamflows, the temperature regimes, and turbidity levels under state law but based upon consultation with this Bureau.

The Bureau of Commercial Fisheries is concerned with commercial fish, whales, seals, and sea lions. The maintenance of an adequate commercial fishery is quite dependent on adequate planning for pollution control. There is evidence of all kinds of problems in the Columbia River, such as decreased dissolved oxygen and slime growths caused by pulp mill effluents which foul the nets of commercial fishermen. The planning effort concerned with water temperature, water turbidity, and the maintenance of adequate minimum flows is vital to the commercial fishery. These requirements vary widely; information is needed to maintain temperature regimes for rearing purposes, another for spawning purposes. The pollution control plan can specify alternatives in terms of water quality which will maintain, enhance, or obliterate the fishery. The fisheries agencies, both state and Federal, commercial and sport, are thus vitally concerned with the choices indicated within the pollution control plan.

The Geological Survey is responsible for the continuing inventory and appraisal of the quantity and quality of the Nation's surface and ground water. It operates a national network of more than 1,300 water quality stations to determine chemical properties, sediment content, and temperature of surface water. It also prepares analytical and interpretive reports on geochemistry and chemical quality of water. Survey water data are used by other agencies, Federal and local, in developing water management plans. For instance, time-of-travel studies being carried out in the Willamette Basin by the Survey with the assistance of other Federal and state agencies will be invaluable in developing plans for pollution control.

The Bureau of Reclamation is another Bureau of the Department which depends on the pollution control plan for aspects of its planning and construction. The organic Act of the Bureau of Reclamation was passed in 1902.

This Bureau is concerned with the quality of water as affected by irrigation. Within its multipurpose structures operation it can manage flows, temperature, and turbidity. For instance, its structures can remove sediment, regulate temperature through releases at multiple levels and, of course, regulate waterflow for augmentation. Crops

grown under irrigation and processed with water in winter months yield effluents which contribute to pollution when reservoir releases are limited by low inflows.

Each of the Bureau of Reclamation projects is specifically authorized. The new authorizations--those that have taken place since the basic Federal Water Pollution Control Act of 1956 was passed--include water supply and water pollution control consideration. The Bureau of Reclamation looks to the pollution control plan for choices on the pollution control possibilities of multipurpose structures for which the Bureau has authority.

The Bureau of Reclamation is concerned with the chemical quality of water and studies this at each project to determine suitability of the water for irrigation purposes and for municipal and industrial use. The Bureau engages in a monitoring program to provide water pollution control information at most of its projects. These include determination of total dissolved solids, chemical analyses, chlorine analyses, dissolved oxygen sampling and water temperature sampling. It engages in debris and sediment removal at many dams. The Folsom Dam is one Bureau structure where water temperature is being regulated.

The Bureau of Mines has broad authority to conserve and develop the mineral resources of the United States. It is concerned with the health of people engaged in mining and in preventing wastes of minerals. Its interest in water pollution control plans is for information on quality of water requirements for mineral and metallurgical industries. For example, the water pollution control plan can provide information on the water requirements and choices of possible or acceptable sites for metallurgical industries. It can provide the basic information on what it will cost to provide various levels of treatment to the effluent from metallurgical industries. The Bureau of Mines is also concerned with the water-borne wastes from mining and metallurgical activities. It is concerned about disposal of radioactive wastes resulting from uranium and other operations and with water requirements to prevent pollution from mineral, petroleum, and natural gas extraction, and with pollutant acid mine water.

The Bureau of Land Management derives its basic authorization from the Taylor Grazing Act of 1934. It administers 172 million acres of public land in the western United States. These are the poorer lands; many have alkaline soils. One of the interests of the Bureau is the management, use and development of cover on these lands to prevent erosion and to reduce sediment movement. It also advises and prescribes certain requirements of Public Law 566 of 1954 (Small Watersheds Act, U. S. Department of Agriculture) when such improvements take place on Bureau of Land Management lands. This Bureau is directly

concerned with water pollution control planning where such programs as management of livestock, prevention of range fires, and control of use of chemical herbicides and weedicides and pesticides are pertinent to the water pollution control plan.

The National Park Service's principal concern with water pollution control planning is in the operation of some 1,500 large-sized water supply systems in connection with the National Parks and in the management of refuse and sewage disposal systems within the National Parks. In addition, they are concerned with the degradation of aesthetic and ecologic values which result from pollution. This is particularly relevant in some of the more heavily populated areas of the East. As an example, the Potomac River is frequently cited as a horrible example of aesthetic losses from pollution. The National Parks management's concern with aesthetics and ecology makes the end product of water pollution control planning relevant to park planning. The National Park Service, because of its management responsibilities, is also aware of and concerned about the use of insecticides and pesticides and their potential ecologic and aesthetic relationships. Such questions as whether to control epidemic insect infestations require most difficult ecologic and aesthetic decision in which water pollution control planning information is important.

The task of the Bureau of Outdoor Recreation is that of coordination between the various Federal and state people who have some interest in outdoor recreation. They are interested in any abatement of pollution because it would result in the increase of water available for recreation use. A water pollution program which defines how and where quality and quantity of water can be maintained for recreation use is needed by this Bureau in providing assistance to the states in recreation planning and in its coordination responsibilities. The Bureau criteria have been that the maintenance of flows for the fishery will usually and inherently provide aesthetic quantities and quality for recreation. This, however, may not always hold true. It is probable that at a future time the concern of the Bureau for flows may not be provided adequately within other flow requirements. Such rivers as the Potomac, the Sacramento, the Willamette, and the Columbia, which are near population centers, may have recreation flow requirements over and above other flow requirements.

Federal Power Commission

The Commission, through Section 10(A) of the Federal Power Act, requires comprehensive plans by the applicant seeking a license for a structure (private or non-federal utilities). One of the elements of a comprehensive water plan is a pollution control plan. Up to the recent time--at least, until the passage of the Federal Water Pollution

Control Act of 1956--I think pollution control planning in these comprehensive plans was cursory. However, the Federal Power Commission is in a position to require streamflow regulation, for pollution control purposes, as a part of licensing in the same way that flows may be required for the maintenance and enhancement of fishery.

Any program of pollution control which is developed from water pollution control planning and incorporated into reservoir management can have a very important bearing on power production. For example, storage of water for pollution control purposes may provide head for power production. However, in the case of plants which are operated for peaking (the production of power during the hours of peak loads), plant operation may greatly curtail the flows except during these peaking operations. There may be little water released during the bulk of the day and then during the evening hours when the peak load occurs water may be released. This kind of fluctuating flow for power operations can be detrimental to water quality and other flow requirements. It is possible for licenses to recognize this and to provide for certain minimum flow releases for fishery and water pollution control, including adequate dissolved oxygen. Licenses may also require skimming for pollution control and, although this hasn't occurred yet, may at some future time provide for temperature control during the fishery spawning season.

In addition to the above, reservoir levels may be manipulated for purposes of mosquito control. Another concern which soon may be of major significance is thermal pollution (the increase in the temperature of water resulting from various operations, such as thermal generating plants). The operation of generating plants and extensive irrigation may cause a rise in temperature of 12 to 13° in a very large volume of water which, as return flow in accumulative effect, can result in thermal pollution.

In lightly reviewing the responsibilities of the various Federal departments in water management, it is apparent that there is a host of interrelationships between the pollution control plan, on the one hand, and the planning and operation of water structures and related resources programs on the other. The relationships range from so-called rim-to-rim watershed concepts in which the management of lands have peripheral impacts on the quality of water to the quite direct impacts of the actual operation of major water control structures. People who deal with the subject are not always aware of the interrelationships or concerned about them. Tremendous strides have been made in the nine years since the passage of the basic Federal Water Pollution Control Act. Also, really pressing pollution problems in some parts of the country are achieving broader public recognition.

COORDINATING MECHANISM

To illustrate the coordination mechanism being used in river basin planning in the Northwest, I will use some charts. The first of these depicts coordination through the Columbia Basin Inter-Agency Committee, a field arm of the Inter-Agency Committee on Water Resources, in Washington, D. C. The chart is self-explanatory and illustrates the complexity of coordination. Seven major Federal departments and seven states have responsibility spread over a whole lot of activities. Down in the lower left-hand corner, the Coordinated Planning Subcommittee is emphasized. It is the particular arm of CBIAC for river basin planning coordination. You will also notice on the far right that we have a Water Supply and Pollution Control Subcommittee, which is concerned with providing broad coordination between state and Federal and local water supply and pollution control programs, and incidentally, does so very effectively. Turning now to Chart No. 2, going from the Coordinated Planning Subcommittee to the Willamette Basin, we have a special Task Force in the Willamette Basin whose job it is to provide coordination in the currently authorized review. In the upper box, you see that this again includes seven Federal departments but only one state. This basin is totally within Oregon. Under our rules, the State of Oregon is the Chairman of this Task Force. Following down, we move from the Task Force, a policy-level group, to the Outline Schedule Group. The latter are full-time employees devoting all of their attention to the Willamette Basin study. They are the Section leader for the Department of Agriculture; the Chief Engineer for the State Water Resources Board; the Section leader from the Bureau of Reclamation, who represents all of the agencies of the Department of the Interior; the Basin planning chief for the Department of Health, Education, and Welfare; and the Section leader for the Department of the Army. In this instance, the Department of the Army is the Chairman of the Outline Schedule Group. These people might be considered to make up an unofficial full-time staff, devoting all their time to the Willamette comprehensive plan.

The areas of concern, broken apart for purposes of this discussion, are physical information, natural resources information, economic environment information, current water uses and future water needs, existing developments, present water uses and future water needs, and finally, in the right-hand column, water and related land resources problems.

In subsequent work, we have come to agreement that the final report will include appendices concerning the beneficial uses of water as defined in Senate Document 97, plus three basic appendices, one dealing with the whole area; the second, dealing with the hydrology; and a third, the economic base. Finally, there will be a plan

CHART I

COLUMBIA BASIN COORDINATION

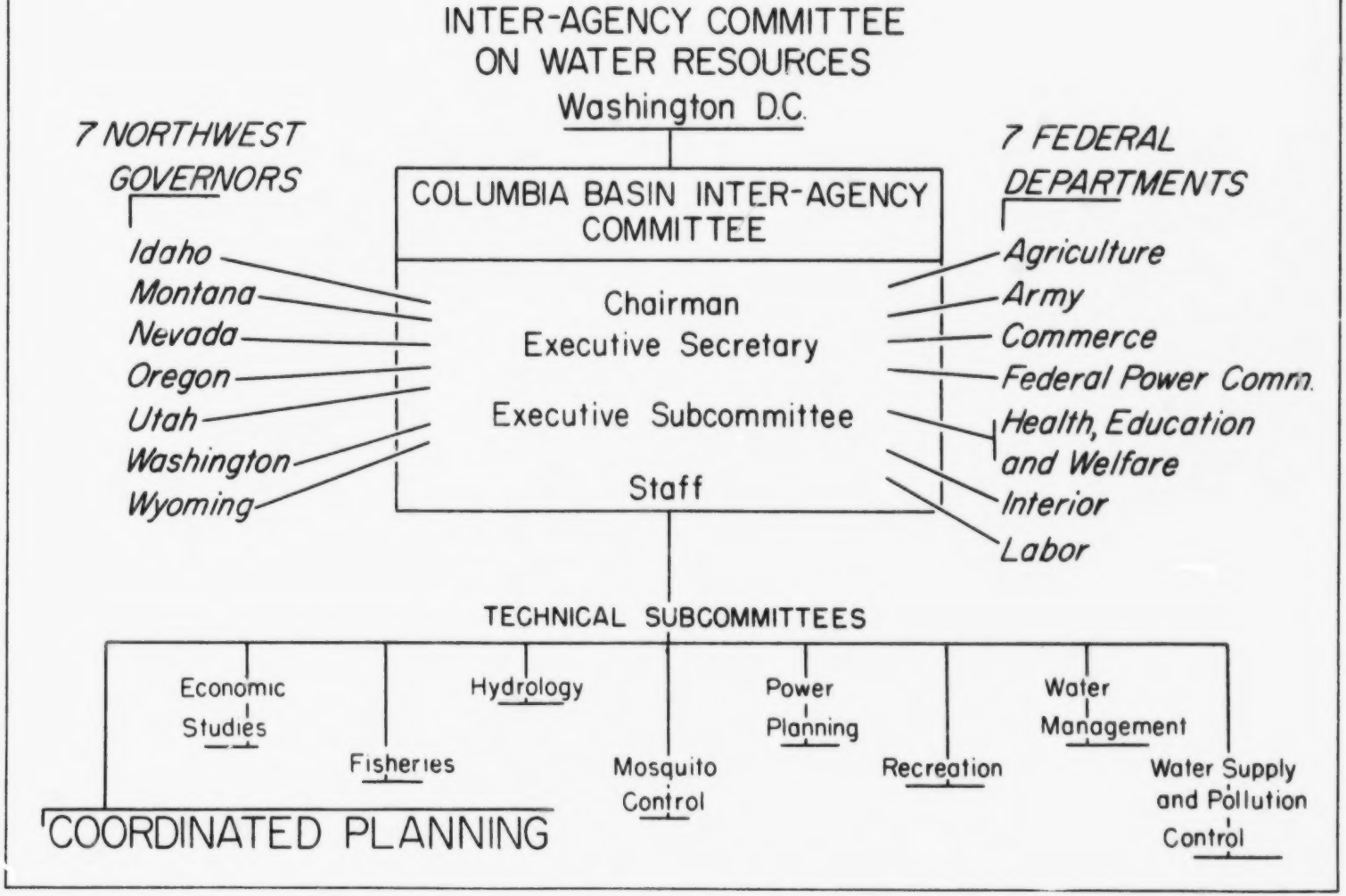


CHART 2

WILLAMETTE BASIN COORDINATION
COORDINATED PLANNING

WILLAMETTE BASIN TASK FORCE

U.S. Dept. of Agriculture
Army
Commerce
Federal Power Commission

STATE OF OREGON (Chairman)

U.S. Dept. of Health, Education and Welfare
Interior
Labor

OUTLINE SCHEDULE TEAM

Agriculture
State of Oregon
Interior
Health, Education and Welfare
Army

ANALYSES

PHYSICAL INFORMATION
- Physiography
- Geology
- Climate
- Land Characteristics
- Stream
- Vegetation
- Cultural Development

NATURAL RESOURCES
- Surface Water
- Ground Water
- Land
- Fish and Wildlife
- Recreation

ECONOMIC ENVIRONMENT
- Agriculture
- Food Processing
- Forest Products
- Recreation
- Mining
- Fish and Wildlife
- Population
- Manufacturing
- Services
- Government
- Trade

CURRENT WATER USES AND FUTURE WATER NEEDS
EXISTING DEVELOPMENTS, PRESENT USES and FUTURE NEEDS
- Domestic
- Municipal
- Industrial
- Mining
- Irrigation
- Navigation
- Power
- Fish and Wildlife
- Recreation
- Water Quality
- Land Stabilization
- Watershed Protection

WATER and RELATED LAND RESOURCES PROBLEMS
- Domestic
- Municipal
- Industrial
- Mining
- Irrigation
- Navigation
- Power
- Fish and Wildlife
- Recreation
- Water Quality
- Flood Control
- Drainage
- Land Stabilization
- Watershed Protection
- Forestry
- Legal
- Land Utilization

PLAN

formulation appendix. I think these charts help illustrate the interrelatedness of concern in planning.

We are talking here today about the interrelatedness of the water pollution control plan with the activities of other Federal agencies. To really fill you in, in detail, about the Willamette Basin Task Force would require too much time. Suffice to say that the Task Force has made much progress in the last two years. Participants are in general agreement that this effort, without a regular staff, is extremely difficult but is the only working arrangement available. We have achieved agreement that we are going to produce a single report and that this single report will be as comprehensive in scope as we can make it with the money and the men we have available. It will include a broad framework and projects that are needed in the next 10 to 15 years in sufficient detail to seek authorization. It will discuss such things as programs which need to be strengthened or started. It will discuss legislation requirements and such needs as modification of water resources governmental structure.

Chart No. 3 depicts the broad review schedule for this report. Coordination is a continuing responsibility and is scheduled for the entire period of the study. Public contacts are regarded as an important continuing responsibility through the whole procedure.

Public hearings and progress reports are indicated as being a responsibility through the whole study period. The determination of the needs, potentials, and the development of supporting data, interim reports, started back about the middle of 1963, the year the study was authorized, and carries on to about early 1968. There will be a time when one can't go any further with this determination of needs and potentials and must get right down to the final plan formulation and report draft preparation. This is indicated as beginning about 1967 and running through to early 1969. Agency review is scheduled for the middle of 1969 and report publication at the end of 1969.

SOME ESSENTIALS TO EFFECTIVE COORDINATION

Now, to summarize quickly items c and d of my paper, I will state what I think are some of the essentials to effective coordination. Our experience, to date, shows clearly communication is our principal problem. There are so many people involved in this thing that it gets to be very difficult to see that the right intelligence gets to the right people at the right time. A second important problem is to be sure that the levels of coordination are distinct and clear. It is futile to attempt to coordinate policy questions at the "doing" level,

and it is equally futile for the policy people to coordinate details that go into the planning. This is some of the kind of thing that happens unless there is a good understanding.

A third point is that coordination doesn't necessarily imply agreement. It implies a free and open discussion, an airing of differences of view, modifications in points of view. In the final analysis, it may mean that after considering all the aspects we don't agree and this may lead to alternatives. I think this is rather an important distinction. We can cooperate effectively, we can talk together extensively, yet finally we won't always agree but we will have achieved coordination.

A fourth consideration is that of time. Coordination takes time. The people who have responsibilities in this field have to be willing to devote the time of the right people to the job. This gets to be a real problem. Action agencies want action and they often consider that the time devoted to meetings and discussion of differences of opinion and points of view, detract from getting action. Thus, some are reluctant to devote the necessary time and the talents of the right level of people to the job.

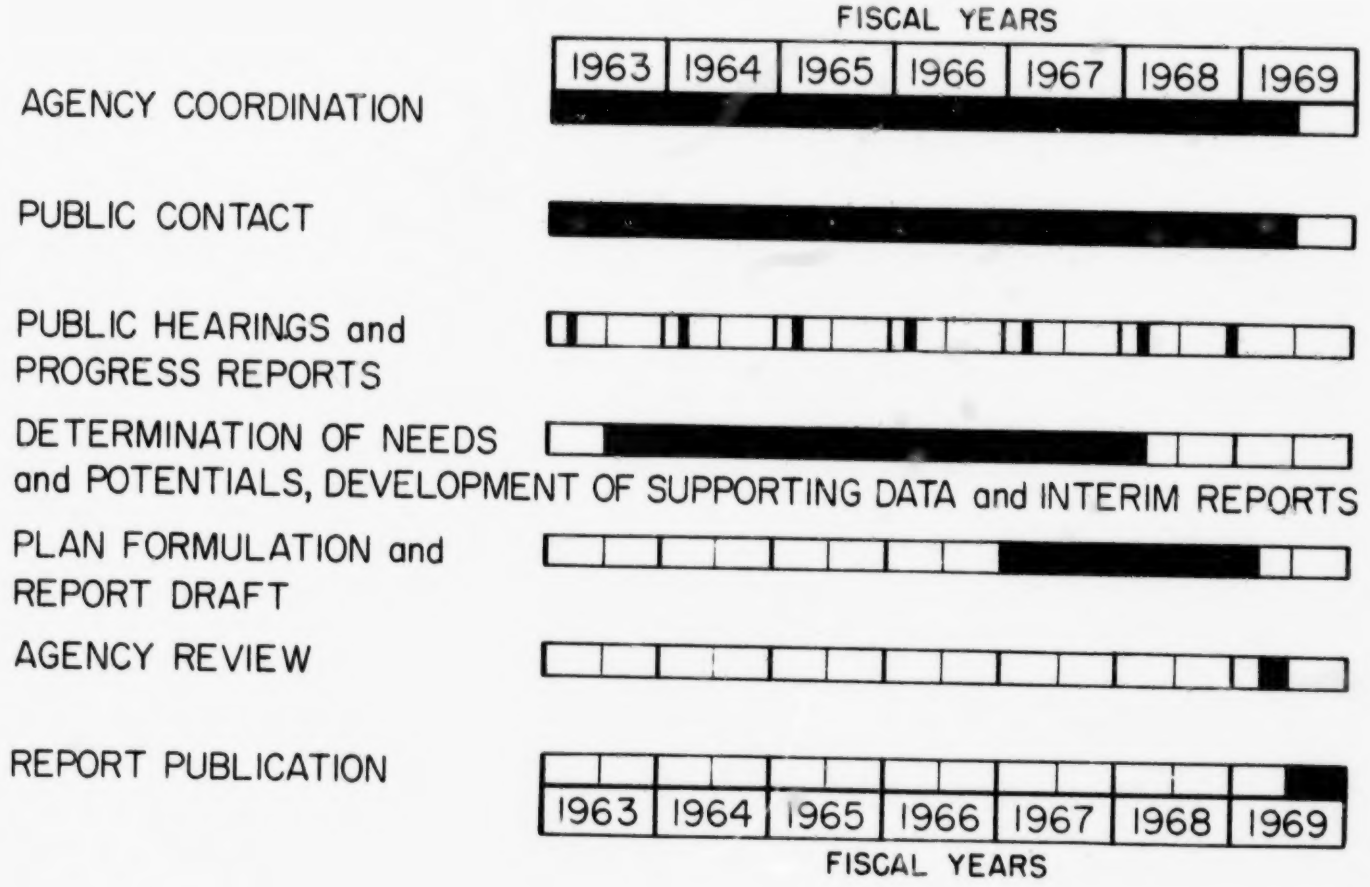
I think the time is past when we can take single points of view. What one department does affects a number of other departments in a variety of ways. It is essential that we acknowledge the fact that this kind of coordination is the job of some of the best people.

A fifth point is that coordination should be achieved through a variety of coordination mechanisms. The Task Force is not the all-in-all of coordination. There is a great deal of coordination taking place regularly between agencies. There are some kinds of work that encompass the interest of all agencies and these require a broader approach. The coordination that takes place in a whole variety of the Subcommittees of the CBIAC is relevant to the kind of coordination required in a comphrehensive planning effort.

The sixth point is that coordination has to range over a variety of organizational levels. It has to take place right out on the ground where the work is being done. It has to take place at the local level of government. It has to include the interests of a wide range of nongovernmental public groups. Historically, some of the best coordination has been done right at the grass-roots level between on-the-ground people. However, this needs to be done in a larger over-all framework because the coordination achieved on the ground may be at variance with higher level policies and come to blows at a later time.

CHART 3

REVIEW SCHEDULE



SOME PLANNING CHALLENGES

Finally, coming down to the challenges, it seems quite evident, in view of the many pressures that are upon us, that we must do a much better job of realizing the potentials of our land and water resources. We must make the most of our resources, not only for regional reasons and national reason, but so our natural resources may properly contribute to a more stable international situation.

One serious problem is communication. More often than not, we find that we are talking to ourselves. We here today are essentially resource people, but to what extent do we, as individual resource people, communicate with the community at large? To what extent is the work that we are doing in resources--in the broadest sense--understood, believed in, and sought by the public? These kinds of questions demand concern and self-evaluation by each of us in the resources field.

The space program has done a tremendous job of capturing the public imagination and has achieved widespread public enthusiasm. The goals we are pursuing in space programs are radically different from our resources goals, but we must engender the same kind of public enthusiasm for them. The penalties of failure, in terms of the kind of civilization we have out ahead 50 and 100 years, will be very severe.

There is the challenge of people to do the job. Are we moving ahead in encouraging young people to enter into the resources field, to enter into the disciplines associated with water supply and water pollution control and the related resource programs? Are we developing the generalists who have the broad understanding of resources and will be competent to integrate water pollution control planning with other resources planning in the larger scene? Are we bringing people into the work who are talented and accomplished in social, economic and political disciplines?

Can we make progress not only in the technical scientific field--the know-how of water pollution control--but, also, in the more subtle problems of how we motivate people to accept rapid changes and make social and political adjustments and decisions required?

Still another challenge is whether or not we have provided the optimum governmental structure to carry out the problems associated with water resources planning and development. This opens up many new questions. We have seen just recently problems of water supply created by flooding. A town with water on one side of the river and a town without water on the other side of the river. No connection between these, little interest in making these kinds of interconnections

or in providing some governmental framework within which better arrangements can be made. Our problems associated with urban sprawl and tax structures are all encompassing.

I believe we must be concerned with these social, economic, and political questions every bit as much as, and perhaps substantially more so than, we are with technical, scientific questions. If we will apply the same thought, the same imagination, the same energy, and the same faith and conviction to answering some of these latter questions, then our technical answers may more nearly achieve our goals.

THE STATE'S ROLE AND USE OF POLLUTION CONTROL PLAN

Fred Merryfield
Professor of Sanitary Engineering
Oregon State University
Corvallis, Oregon

INTRODUCTION

We appreciate the opportunity to participate in this well considered program which has been provided for us by the staff of the Pacific Northwest Water Laboratory of the Public Health Service at Oregon State University today.

The previous speakers have discussed the purposes and comprehensive plans for water pollution control of a geographical area larger than several of the well-known nations in Europe. We have also heard of the fine coordination activities of the Columbia Basin Inter-Agency Committee which represents the state and Federal agencies responsible for the use and control of the waters of this basin.

Engineers from the more densely populated areas of the world might smile when we speak of water pollution in connection with this less dense and less industrialized area, yet we have been and are concerned with severe pollution of some stretches of our river system

It might appear, at first thought, that with the rather bounteou supply of water allocated by Nature to this area, pollution problems now and in the future are not of regional importance. If we are to learn from the past, we should recognize that we can avoid by careful and comprehensive planning and implementation some of the extremely serious and costly troubles which arise from indifference.

The pollution of our watercourses, both by Nature and by Man, have been going on for centuries in the former instance and for the last 75 to 100 years in the latter case. The invention of the water closet, the development of industry, and growth of our cities have all contributed to the pollution of our river systems. It is necessary to examine in some detail the conflicts which exist and have existed concerning not only the quality of water, but also the actual uses.

Rivers have been used to transport the wastes of mankind for centuries, and the very act of disposal has tended to produce an ignorance of the consequences of such an act. Quality of the receiving stream is impaired, but the people who are responsible for this

do not usually suffer the immediate consequences of such an act. By treatment of the river water and treatment of the liquid wastes prior to disposal, we have been able to provide water for specific purposes and reduce the obvious pollution. Some of our rivers are seriously polluted at low flows. State laws and agencies have been created to protect the community health and abate pollution. Resolution by law alone has not and cannot resolve the technical and economic problems of water pollution, but laws promoted by interested people have focused attention to it in the past fifty years. It is becoming apparent that the economics and the general social health of the region can be affected by water pollution. We have been aware for a long time of pollution in local areas of the Pacific Northwest, and considerable progress has been made in reducing some of the pollution.

The quality of water has many meanings, most of which are related to the use of the water itself. Water, of course, is used for so many purposes that we are inclined to forget the diversity that exists on any drainage basin. Water is used in this region for domestic supply, power, irrigation, navigation, recreation, industry, fish and game production, and the stream itself is used as a passageway for the anadromous fish which populate the river systems. In recent years the recreational value of water, which is an indirect use, has become of great importance to the well-being of our citizens. With the use of more leisure time, it has become apparent that the public has become more conscious of water pollution and today are requesting water pollution abatement. Some of our conservation associations have been in the lead for many years, calling attention to the pollution of the river systems and the need for technical and legislative action. Many of these people have contributed in no small manner to the legislative actions of our state and Federal government. The development of our social consciousness in the field of water pollution abatement is in no small way dependent upon their continued interest and action of the past 50 or 60 years. We have reached a point when there is need for a thorough review of the water qualities of our rivers, for forecasting the future anticipated situation, and for creating a better understanding for defining areas of responsibility of the various levels of government. We need to define water quality in terms of use, to determine what qualities are needed, what methods are needed to achieve these standards, and the costs of such programs and the benefits to be attained.

It is obvious that the technical people alone cannot accomplish this without a public approval. But, it is the function of the technical people to inform the legislatures and the public so that such action can be assured.

State's Role

A few moments ago we mentioned that in spite of what appears to be in the Pacific Northwest an abundance of water for all uses in the foreseeable future, nevertheless we must be prepared with an effective quality control program for this region. Technical and scientific developments will aid us, but the large projected increase in population with the larger demands on our water resources requires comprehensive planning. These plans must be economically justifiable and have public support.

It is proposed to review the present situation, some of the future problems that will be encountered, and to discuss in a general way some features of quality control.

WATER QUALITY CONTROL

Solution to most problems requires recognition of its existence, the extent of it, a review of related factors which are connected with it, development of methods necessary to cope with the problem through collection of and analyzing data, and formulation of plans to resolve the problem. Plans must be compared, technically, legally, economically, and sociologically; and, finally, the plans must be presented to the suitable authorities for acceptance and modification. Good planning infers good implementation. Good feedback and periodic review of the plans and developments with modifications to the plans are essential.

In any resource planning the character of the resource, its use and availability, and the quality of it are important. It is essential that the particular resource be studied with respect to other resource development within the region.

Water is a most unusual resource. It is absolutely essential to life, it can be reused, and it is redistributed annually. It has peculiar variable geographic and seasonal distributions which are most difficult to forecast.

The natural flow of our rivers is dependent upon the geology and topography of the region as well as upon precipitation, temperature, vegetative cover, etc. This flow is seriously affected by storage and releases, extraction for irrigation, and diversion from the drainage basin. One would be guilty of negligence if one failed to point out the possible extraction from the Columbia River Drainage Basin of water for transportation to the southwest and its effect upon the quality of some of the waters in the system.

It is also apparent that the economic storage of the waters is limited and it is further conceded that demands by industry,

irrigation, power, etc., will continue to increase at a very rapid rate. The demands by our populations for municipal water will, of course, increase, but in general the amounts used are still not in great quantity. However, there are many localities where sources of domestic water supply are completely inadequate.

There is a grave difference between the flow of the Columbia River and the flows of the individual rivers in the basin. Some public discussions have failed to make this clear. There is a wide variation in the availability of water within the basin, even in the coastal areas. The availability of good quality water is economically very important, but it is essential that quality be defined on a utility basis.

Much has been achieved to date in setting up standards, but more information is needed on toxicity, satisfactory biological environments, effect of releases of stored waters and treated wastes into the river system, the quality and amount of water returned from irrigation and the amount of thermal pollution. Some of these questions will require creative and painstaking research.

Industry, as in the past, will continue to produce new materials and, consequently, new and far greater volumes of wastes. Research will be required in all aspects of quality control. Location of industries will become more of a problem and processing within the industries will be studied to reduce and eliminate where possible the wastes themselves. This is a severe technical and economic problem. The design of economic water and domestic and industrial waste treatment plants will require great creative ability. Operational control must be exerted within these plants to produce desired qualities of effluent.

In this region the states' laws of ownership and use of water are based on either beneficial use or riparian and beneficial use. Many legal conflicts in this matter have been resolved but there is still need for further clarification and modification within the individual states. Some confusion exists between Federal and state statutes. Technical people need to become more familiar with these legal conflicts. Many laws concerning water resource development will be written in the future by the state legislatures and Congress, as in the past. There will be greater need for clarification of conflicts within the laws. We can be of aid in resolving some of these critical problems of jurisdiction and objectives.

It is also apparent that we have a multiplicity of agencies created by laws of Congress and state legislatures for specific purposes with respect to the use, law, and control of water. We cannot here enumerate them, but we have had an opportunity today of learning of the excellent technical coordination that has been achieved

between Federal and state agencies during Mr. McNeil's discussion of the Columbia Basin Inter-Agency Committee. Frankly, we should give credit to many of our agency groups, both the policy-makers and administrators, for the excellent achievements to date in the difficult multipurpose planning. In the past 30 years many multiple-purpose projects have been built. Are these designed and operated for quality improvement and maintenance? We might ask "what quality." The multiple-use concept is, in itself, a compromise which produces technical, economical, and social conflicts difficult of resolution. It is pertinent to point out that surplus waters in all our western states are under very severe legal scrutiny and that some of our state resources boards have only the power by law to allocate the use of these surpluses. Under the law of beneficial use, the surplus waters in some instances have already been transferred to other drainage basins. Much of the water in the more arid sections has already been adjudicated.

THE ROLE OF THE STATE

The role of the state is five-fold. We speak here in gross terms including not only the technical phases, but legal, economical, as well as the sociological consequences. Each state should provide identifiable and recognized participation and leadership in these areas:

1. The individual state's role, where required in cooperation with other states and the Federal government, is to develop, mutually, adequate technical criteria for water pollution control and programs for the implementation and achievement of these criteria. The objectives of the comprehensive plan to be achieved should be clear and the area of the state responsibilities and authorities well defined.

   Comprehensive plans for water pollution control must, of course, be justifiable, acceptable, economical, legal, and measurable. It is the individual state's responsibility to strengthen its share of the enforcement program where needed.

2. Certainly, each state should concern itself with the technical phases involved; namely, in helping coordinating the activities for assembly of data on water resources, assembly of data on waste treatment, evaluation of the effectiveness of waste treatment on the receiving streams, effect of storage and storage

releases on the quality of the streams, requirements for fish culture as regards both quantity and quality, control of the operation and effectiveness of treatment plants, and the establishment of the value of water quality in the state's economy.

It would appear that in projections into the future the state should definitely concern itself with all of the water use areas, define water quality by use, aid in the development of economic means for the use of water, the effect of wastes and treatment in the future, and certainly should be prepared to establish the state needs prior to diversion from drainage basins within the state. Further, the state should be able to determine technical and economic effects of such diversions on the future downstream qualities of the rivers.

The state itself should be responsible for its internal stream monitoring and development of a control program, possibly, by the use of instruments and computers to reduce the costs of stream pollution control.

3. Each state should be responsible for the review of the legal phases of pollution, and pollution control, and certainly should resolve to the best of its ability the problems connected with the ownership and use of water. Unquestionably, it will be necessary to enact legislative amendments which will enable state and Federal agencies to develop the water qualities sought and to simplify and clarify those laws connected with future water resource development and projects. There must be, as in the past, strong executive state leadership. We would further point out that all of this can only be achieved through an informed public and legislature. A well-coordinated public information program should be developed based on fact and the possibilities that exist in the future.

4. The state's role further should be to review periodically and measure in some manner the effectiveness of the comprehensive water pollution control plan which will be of benefit to not only the state itself, but to the region and nation.

5. It is quite obvious that no state can assume this role unless it provides adequate financing for such a program, and only by attracting to the state's administrative agencies knowledgeable and dedicated people can the state expect to use the comprehensive plan of a large basin, such as the Columbia.

WHY SHOULD A MUNICIPALITY BE INTERESTED IN A COMPREHENSIVE RIVER BASIN PLAN FOR WATER POLLUTION CONTROL

Roy W. Morse
City Engineer
Seattle, Washington

Municipalities definitely are affected by river basin planning. We are water oriented. Every city is situated on a river or on some body of water, and we are interested in every phase of water use. Water is the life blood of cities and towns. Like a living creature, it is carried through arteries and veins to every living cell of our existence - our homes, our places of business, and our industries. Without this life-giving fluid, our cities would die just as surely as a living creature would die without blood. It passes through our homes and carries away the impurities and waste and must be reconstituted before it is reused.

We are tied into every phase of water use. Hydro power lights our homes and streets and turns the wheels of industry. Irrigation and fisheries furnish us the food products. Flood control protects our cities from loss of life and property. We also depend on water for much of our recreation such as boating, swimming, fishing, picnicking and the aesthetic values of water scenery.

Municipalities of the Northwest are greatly favored by climate and topography in sources for their domestic water supply. Each municipality has temporarily solved its individual problem in obtaining the best available source of water as to quantity and quality.

We are generally favored by an abundant rainfall with wooded mountainous areas to act as collectors and ground water reservoirs. Some municipalities, however, have found it necessary to reuse river water contaminated by other uses. Officials of these municipalities are directly concerned with pollution control of the river basin above and below them. Our interest is broader than this, however, because every source of domestic water supply has some pollution problems even to the few fortunate cities that have been able to control the watersheds above their points of diversion. The extent to which these waters have been polluted at the point of diversion determines the extent of treatment necessary and the ultimate degree of safety and quality of the water.

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The problems of water quality are greatly compounded by upstream usage. Nearly every water use has some deleterious effect on reuse of water for domestic supply.

Discharge of sewage treatment plant effluent into a river is the most common example of the effect of water use. We like to believe that this water is safe and it may be reasonably safe from disease-carrying bacteria, but what about the chemical change? Use of modern synthetic detergents, insecticides and other household cleaners has created problems. These substances are not easily removed and have proven to be a problem if not adequately diluted.

Even storm water runoff from populated areas carries some pollution to the river or other receiving waters. While it is not presently considered practical or necessary to treat urban storm water, it may some day become a factor in the pollution of river basins.

Storage of water in power or flood control reservoirs has an effect on water quality. Shallow areas subjected to sunlight produce a rapid growth of algae. While these may not be harmful to human use, they do affect water quality in taste and odor.

Use of water for irrigation has affected water quality in some cases by minerals dissolved from the soil which flow back into the river through subsurface drainage. Such minerals may increase the hardness of the water or add objectionable features such as result from high iron content.

Why should we, who have temporarily solved our individual urban problems of water supply and pollution control, enter into river basin planning?

First, we are unescapably tied into water use. We cannot deny our interest in this use or our responsibility for the pollution which we create.

Second, we have the future to consider. Recent years have shown a growing emphasis on river basin planning. Federal agencies are expanding their studies and will soon have completed preliminary studies of every river basin in the country. The U. S. Corps of Engineers, which once was only interested in flood control, navigation and power generation, now includes the additional fields of irrigation, fish and wildlife enhancement, water quality control, water supply and recreation. The Bureau of Reclamation, Health, Education, and Welfare and the Soil Conservation Service, are also making planning studies. These plans being made today will be translated into construction projects of the future. Laws will be passed and water rights granted that will affect water use for many generations. We municipal officials must

consider our responsibilities to the future and see that the needs of our cities are given adequate consideration. We cannot afford to do less. We know that the average per capita demand for water use is increasing. Will there be enough water for every use in the year 2000 to 2500? The answer is obvious. There isn't enough water today for every use in many areas. Water reuse, redistribution and desalting efforts will become more important to meet future demands.

As important as water is to life, it already has been rationed in over 1000 United States communities in a single year. The Pacific Northwest and the United States have no absolute shortage of water at this time - the shortage is either confined to areas of low rainfall or it is one of facilities such as reservoirs, conduits, filtration plants, etc. and some of these have not been adequate since 1940. Many factors have contributed to this water shortage. These include population growth, industrial activities and irrigation. But the greatest reason for water shortage is inadequate advance planning.

The third reason why cities should enter into river basin planning is that we cannot "go it alone" as we have in the past. Most cities must ultimately accept water that has had one or more previous uses. We can only reconstitute this water for our use if the nature and extent of its pollution is controlled so that it can be treated by known methods. If we cannot remove chemical wastes from our water supplies, we must prevent them from entering the water at their source.

What can municipalities do to meet the present and future problems of pollution control?

We can put our own house in order. That is, if we are not now providing adequate treatment of waste water from our city, we can take measures to bring our cities up to accepted standards of pollution control.

We can coordinate our planning with the over-all planning for river basins. This means better communication with officials of other municipal, state and federal agencies. It is only through person to person contact and acquaintance with other people in the water resources field that we attain a mutual trust and respect that is so necessary in moving successfully forward in joint undertakings.

We can participate in the drafting and passage of legislation that will effect a fair distribution of water resources and protect regional interests.

We can participate in the financing of research that will solve future problems related to new methods of water treatment for maximum pollution control.

We need a fast and efficient method for sterilizing waste water and the removal of objectionable solids and chemicals in sewage. We are living in the atomic age, the age of electronics, jet propulsion and space exploration. And it is my personal feeling that we are using horse and buggy methods in our water and sewage treatment. We need a break-through in these fields. This break-through can only come through research. Research will be costly and can only be financed by joint undertaking.

We need research in all aspects of water use. This research is being undertaken by our universities, of which Oregon State University is an outstanding example. Their research activities show that they have long recognized the needs in this field and are meeting the challenge. We must support them in every way.

Finally, we need to improve our public relations. Research symposiums will help us to coordinate our thinking. Comprehensive planning will tell us what action we should take. But plans translated into action invariably require financing and here is where our planning fails unless we are willing and able to sell what we have planned. We must convince our federal, state and local officials and the people that they represent that they need what we have planned. We must organize our communications and public relations as thoroughly as we organize our planning and engineering.

CONCLUSIONS

To summarize the above points:

Municipalities are inescapably tied into river basin planning for water use and pollution control.

We must plan for the future. The river basin planning that is being emphasized today will cast the die for generations. Cities must join in river basin planning to receive adequate consideration of municipal needs.

We must support research efforts that will provide the answers to present and future technical problems.

We must build up our communications and public relations to attain needed support for our programs.

INDUSTRY'S ROLE AND PARTICIPATION IN WATER POLLUTION CONTROL PLANNING

Walter A. Mercer
Assistant Director
National Canners Association
Berkeley, California

INTRODUCTION

Because no provision has been made here for playing mood music, I will attempt to create a background for my discussion by reading selected passages from current literature. Robert H. Boyle, writing in "Sports Illustrated," November 1964, said:

> This may be the era and the generation and perhaps even the very year that the United States of America, in all its natural glory, goes down the drain. The more I see, the more I am forced to conclude that from New York to California, from Florida to Alaska, much of what is lovely, rich, and real about the United States is scheduled for wholesale destruction or defacement. Almost everywhere America the beautiful is becoming America the ugly, the wasted, the blasted, and the blighted, the home of the neon sign, the super-duper highway, the billboard, foaming detergents, the used-car lot, the useless dam, the monotonous housing tract, the hot dog stand, and stinking pollution galore. Indeed, according to a recent book by Peter Blake, the U. S. can now lay proud claim to the title of God's Own Junkyard. We have, in short, become a nation of pigs.

To this outraged cry of one worried conservationist can be added the cries of a growing multitude of people who feel that America the Beautiful is on the brink of utter spoilation. Let me further delineate the background by reading these excerpts from a paper by the Hon. James M. Quigley, Assistant Secretary, Health, Education, and Welfare.

> Water pollution is a major social problem facing the American people. If I know the American people, it is a problem about which something is going to be done, something much, much more than has already been done. If it isn't done by American industry, if it isn't done adequately and effectively by the American municipalities, if it isn't done adequately and effectively by the sovereign states that make up the Federal Union, then we cannot ignore history. If none of these tnree individually or collectively do the job, it is going to end

> up totally and completely in Washington, and it is going to be done in Washington, not because this is the best way of doing it, but simply because, like so many other things in this day and age, nobody else faces up to the responsibility.

I continue to quote:

> It is not a job that the Federal Government can do alone, it is not even a job that the Federal Government can do best, but it is a job that the Federal Government is going to have to do if it isn't done in any other way by any other group, including industry, which in many ways can do it better.

Today, there is a ferment in the land. The idea that water in our streams ought to be clean, usable water has arrived with all the moving force of a reformation. I believe that industry in general has or will accept the idea and recognize that pollution control is a logical and necessary part of the costs of running a business. But industry's collective responsibilities and individual responsibilities must be defined. It is a complex, multi-complex problem.

Let me quote once more--this time from an industry man--Mr. Leland Doan, former president of the Dow Chemical Company.

> I want to offer you a challenge. It is the challenge that lies in the management of water.
>
> As for complexity, this challenge involves enough factors to brighten the eye of the most avid computer programmer. Questions of science and technology merely begin the list Social, political, and economic considerations arise--and overlap, and compete, and confuse.
>
> The challenge lies not in manufacturing additional water, but in managing an adequate total supply. It must be management that puts water where it is needed and when it is needed, in necessary quantity and appropriate quality, to meet the full range of human and industrial requirements. And this, in my view, is a challenge with particular meaning and appeal for the chemical industry.

INDUSTRY OUGHT TO BE CONCERNED

Since I am associated with the canning industry, I am sensitively aware of the fact that federal agencies consistently point to food processing as being one of the six major industry groups responsible for most of the industrial pollution in the Nation's streams.

As food processors, we know that we must have an adequate supply of water. We know that for the most part the water we use must be clean water. The high standards we have set for quality and cleanliness in food plants cannot allow deviation from this practice.

We cannot, therefore, in good conscience, argue against any anti-pollution measure which is necessary to protect the quality of our water supplies. Here, I have underlined the word "necessary".

We know that the food industry produces large volumes of relatively strong wastes. We know that there are water pollution problems. We cannot afford to be complacent if the situation affects the future of the food industry and the communities of consumers. We cannot afford to shirk any responsibility, either collectively or individually, which may be ours in solving these problems.

Now that I have implied that industry--my industry--may be a polluter of water, although cognizant of its responsibility in water quality control planning, let me hasten to barricade my position with qualifications and conditions.

During the past 40 years, the industry has spent much time and large sums of money in testing and adopting methods of disposal. None have proven universally satisfactory. Problems of variation in the nature and volume of waste and variations in the ability of different treatment systems to handle these variants have produced many problems, often without apparent solution.

A moment ago, I said that we, in good conscience, cannot argue against any anti-pollution measure which is necessary to protect the quality of our waters. Now I would like to point out that there are as many definitions of pollution as there are groups of people concerned with pollution.

To the Fish and Game Commission, pollution is any stream condition which prevents abundant fish life. To the rabid conservationist, pollution is anything which degrades the condition of a stream below that level of pristine purity seen by the first white man to reach the stream.

My adopted definition of pollution is this statement: "Pollution is the discharge of any material that unreasonably impairs the quality of a water for maximum beneficial use in the over-all public interest."

Although the regulatory agencies may be sympathetic to our industry problems, industry would be unrealistic not to expect and plan for more rigid requirements with regard to water pollution control and protection of our ground water resources. We must realize that the water we use is community property and must be returned, after use, in a condition and in a manner which does not damage or otherwise cause undue inconvenience to the community.

I am indebted to Professor McGauhey of the University of California for spelling out for me the criterion which has influenced water management in that State. The evidence accumulated in a study of the "Economic Evaluation of Water" led in 1958 to the conclusion that in a water-scarce or poor quality water situation, unallocated good water should be distributed between various beneficial uses in such a manner as to stimulate optimum growth of the economy of the State.

If one accepts this criterion and attempts to optimize the division of water for economic goals, it is easy to overlook some very important factors. Professor McGauhey cites the example of one southwestern state which is reported to be considering allocating water resources to industry because industry is capable of a 1200 to 1 increase in product value per unit of water input in contrast with a 2 to 1 increase by agriculture.

This overlooks the interrelationship between water and other resources--land, transportation, markets, manpower, raw materials, and supporting industries, which enter into the location and success of industry.

The fate of the California food processing industry, particularly that segment using perishable crops, is irrevocably linked with agriculture. Similarly, the fate of agriculture, as we know it today, in the green valleys of Oregon is dependent on the future welfare of the fruit and vegetable processors. Oregon's vegetable production for processing (green beans, corn, peas, beets, and carrots) increased 32% in the last 7 years. More indirectly affected, but none-the-less dependent on agriculture and food processing, is the future welfare of suppliers to agriculture and food processing.

Now, let's talk about the economic value of the food processing industry in Oregon. Today, a tremendous share of the State's total farm acreage is under cultivation to provide produce for food processing industries.

Remove canning and other food-processing operations from the State and the many thousands of acres now used to produce fruits and vegetables for processing would, of necessity, shift to far less productive crops. It would be ridiculous to try to market fresh the 150,000 tons of green beans or the many thousands of tons of potatoes which are now used by processors. The same is true for other fruits and vegetables, as well as fish, meats, and the specialty foods sold in cans or packages.

Let me take just one crop grown in this state for canning or freezing--green beans--20,000 acres of green beans. Each season, Oregon bean growers are paid 15 million dollars as cash income to grow beans. Much of this is distributed to suppliers for insecticides and their application, for fertilizer, for fuel and equipment repairs, and for seeds and plants.

For the harvested beans purchased from the grower, the processor spends: $9.4 million for metal and glass containers, for caps and lids, and for labels and cartons.

This adds up to more than $24.4 million for the raw materials needed to produce the State's processed bean pack.

Now add to that: $7.8 million to pay the employees of the bean processors and $14 million for miscellaneous costs and shipping charges.

So the --- grower receives 15 million dollars to produce the beans. The processor spends a total of $31.0 million to process and ship the processed beans to the consumer.

Add these two totals together and the bean growers and processors make a direct contribution of more that $46 million to the economy of this State to produce only one vegetable and enough green beans to provide 50,000,000 people with all the beans they want to eat.

Add beans to the other vegetables, fruits, and nuts grown and processed in Oregon and we have a grand total of $227 million dollars worth of economy contributed by the Oregon Farmer, canner, and freezer.

If civilization is not blown from the face of the earth by a nuclear holocaust, we can only expect that the population growth rate of the Nation will continue its accelerating upward spiral. We cannot escape the obligation to increase production of even better, more nutritious foods to sustain the good health and well-being of these multiplying masses of people.

Even now, the net rate of increase in human lives is more than one hundred thousand people per day. How unfortunate, that today

roughly half the population of the earth is undernourished from birth to death. How foreboding, that in areas where population pressures are most explosive, food production is limited or uncertain. Food could be our most effective means for promoting world peace.

In this regard, let us remember that here in Oregon, at Portland's dry cargo port, in 1963, 82.5% of all outbound tonnage consisted of agricultural commodities. An estimated 17% of this tonnage was farm-produced crops. Here in the fertile valleys of Oregon and the entire Pacific Northwest, we have a unique combination of soil and climate that produces abundant supplies of high-quality foods.

I submit that we have a moral obligation to produce and process as much food as we can to feed the hungry peoples of the world for many years to come. At the same time, we must plan to meet the growing food demands of our own people.

WHAT IS NEEDED TO SOLVE THE PROBLEM

Let me assume that we are all convinced that agriculture and the food processing industry are essential to the economy of the Columbia River Basin, to the welfare of the Nation, and the world, and because of this, their current and future welfare should be part of long-range planning for water resources development and water pollution control.

What then is needed to solve the problems involved? What should be the role of industry and its participation in the planning and execution of water pollution control?

I think that the Public Health Service, and other governmental agencies concerned with water pollution control planning, want and need and are seeking the counsel and advice of technically qualified industry people. I believe that only through the cooperative and coordinated efforts of government and industry will such planning develop in a manner which satisfies the regulatory objectives of government and at the same time protects the welfare of industry.

I am convinced that if industry and government refuse or fail to find a way to plan together, if we just muddle along each in its own self-serving manner, sooner or later the two-way street of cooperation will be closed and unwanted legal measures will become necessary to accomplish what needs to be done.

I have heard it said that the Public Health Service does not want the counsel and advice of industry--that if industry ever gave

them any good advice, they would ignore it. I cannot believe that this is true. The record does not bear this out.

Only yesterday, at a meeting where Public Health Service and Industry scientists exchanged research information, Dr. David Stephan, Assistant Chief, Basic and Applied Sciences Branch, Water Supply and Water Pollution Control Division of Public Health, requested the following advice and counsel from Industry:

1. Identify major unsolved problems in the industrial waste field. Are these problems technical or economical?

2. Which problems should the Public Health Service be working on?

3. What are the performance and cost targets for pollution abatement measures needed to achieve clean waters?

This is an invitation to industry to participate in water supply and pollution control planning. In my opinion, industry must respond. It is in the interest of industry and the public to do so.

INDUSTRY'S COOPERATIVE ROLE

Let me presume that I know what the Public Health Service needs from industry located in the Columbia River Basin. I would list three major areas, distinctly separate in some aspects, but overlapping in most, within which industry should develop information, if it is not already available, to be supplied to the Public Health Service or other appropriate agency. The data and information accumulated should be of such a nature that its use by planning engineers would make possible:

1. Long-range projection of the water supply and water quality needs of each major water-using industry.

2. Assessment, for each industrial community, of its current and future waste management needs.

3. Evaluation, for each major type of industrial waste, of the technological and economical feasibility of treatment by available or yet to be developed methods.

Now I would like to add detail to the general areas of need outlined above.

The reservoir and ground water capacity which must be developed in a particular region is a function of the intake water requirements of industry and of the dilution water necessary to maintain specified water quality standards in relation to the waste loads discharged by industry.

In water resources planning by public agencies, assumptions are made about industrial water utilization patterns. These assumptions are made with regard to water intake per unit of product, consumptive use per unit of product, and waste volume and pollutional load per unit of product. But water utilization patterns in industry are changing as a result of changes in the technology of industrial operations and changes in the economics of industry. Today, water resources engineers are basing plans for 100 years of water development on data which are subject to changes affected by intake water costs, effluent controls, and the costs of recirculation of water. Often these change factors have been ignored by public planning agencies in considering industrial water needs. Often industry management has been unable or unwilling to supply sound information to be used for this purpose.

Previous surveys of water use in the canning industry have been inadequate. The National Canners Association, in cooperation with the National Science Foundation, is currently engaged in a comprehensive nationwide study of water usage in food canning. The study is including data on the factors which influence water use practices in the canning of food. It is hoped that the survey results will indicate the extent to which technological changes affect water use and waste disposal patterns. The survey report will be made available to all interested public agencies.

With regard to assessment of the current and future waste management needs of industrial communities, we must assume that certain water quality standards are or will be desirable in the stream to which each community is discharging its waste waters. Achievement of these standards may be by one or a combination of several ways.

Complete or partial treatment of waste can be carried out within the individual plant or operation. It can be carried out totally within municipal or regional waste treatment facilities. Finally, some combination of in-plant plus municipal treatment can be utilized. Where one food processor or pulp mill represents the only industry in a small town, joint treatment in a community facility may be more economical for the industry and the town. Where several industrial plants are located in a given area, the likelihood of economics being achieved by community treatment of wastes is enhanced.

Urgently needed are soundly based formulas for determining the economics of waste treatment under varying circumstances of industrial waste load and community size.

Many communities, within which food processing plants are located and whose sewage treatment systems receive the food plant wastes, experience treatment difficulties during the canning season. We recognize the need to develop information which will enable us to know whether it is more economical to the community to have in-plant treatment of all or a part of the wastes before discharge to the sewer or whether the economics point to centralized treatment of combined wastes.

As an example of the effort needed, the California State Water Quality Control Board supported a project which was carried out by the Research Laboratories of the National Canners Association in cooperation with the City of Stockton, California, and one of the five canneries located in that city.

The general aim of the research was determination of the volumes and characteristics, physical and chemical, of all significant in-plant waste streams and composite waste flows in the processing of peaches and tomatoes. This survey is preliminary to evaluation of the technical and economic aspects of in-plant treatment of strong wastes before discharge to the sewer.

This research is importantly unique and significant because it brings to focus on a common problem the interest and experience of the pollution control agency, the waste producer, and the affected city. The results will be available to all interested persons.

I think it can be said with little qualification, that if costs were not a limiting factor, any type of industrial waste could be treated to the extent necessary to prevent stream pollution. Unfortunately, waste treatment by industry must be economically possible, in the first place, and technologically feasible, in the second place--and one, of course, influences the other. However, necessary water pollution control programs cannot be contingent on economic desirability. It is certainly to be expected that some segments of industry, in some areas, will not survive.

Where not now available, technologically feasible methods of treatment for industrial wastes must be developed. Industry, in most cases, must be given the design criteria and operational procedures for such methods. Generally, this must come from government-supported research. However, industry can play an important role in this development of improved methods.

Industry can and should inform the Public Health Service of its research needs. If industry is supporting research, there should be an exchange of information. Industry should help in assigning priority to government research. Industry should attempt to objectively evaluate the economic feasibility aspects of treatment methods applicable to each particular industry.

INDUSTRY PARTICIPATION IN WATER POLLUTION CONTROL PLANNING

Perhaps you have heard the story of the National Technical Task Committee on Industrial Wastes. In many ways, it is a unique story because the Task Committee has no parallel in history. Today, I also represent the Task Committee. This was the expressed wish of the Committee meeting yesterday in Cincinnati.

Briefly, the story is this. In 1948, Congress passed the original Federal Water Pollution Control Act. This provided for a Water Pollution Control Advisory Board, appointed by the President of the United States. Its assignment was to advise and consult with the Surgeon General about water pollution matters. This Advisory Board recommended to the Surgeon General that he form a National Technical Task Committee on Industrial Wastes to work with and advise the Public Health Service on industrial aspects of pollution abatement.

Because the Task Committee is a committee of industry people representing the Nation's industry, it has been accused of being less than altruistic in its outlook on water supply and water pollution control problems.

Although the Committee was originally organized to give technical assistance to the Public Health Service, there is a current discussion of the need to broaden or otherwise change the scope of the Committee's relationship with the Public Health Service. This is being considered at the request of Mr. James Quigley, Assistant Secretary of Health, Education, and Welfare.

The concensus of the recommendations for change state that areas of future Committee concern, in addition to matters of a technical nature, should include:

1. Policy considerations, including enforcement policy but excluding any participation in actual enforcement activities.

2. Increased awareness program, with emphasis on better communications for:

a. Industry awareness
b. Government awareness
c. Public awareness of progress being made by industry.

3. Economic considerations and feasibility.

4. Legislative proposals, as regards positions that might appropriately be taken on such proposals.

5. Broadening of cooperative role with other organizations.

6. The Task Committee membership should include additional representation from industries participating to encompass above areas of interest, but with each industry to have one vote on the Task Committee.

7. A series of meetings arranged for industry management and Government officials are proposed to include representation of those responsible for top policy determinations in the particular industry with which the meeting is held, the meeting to be followed by a tour to show representatives of HEW-PHS some of the procedures currently employed in taking care of wastes and typical problems confronting the industry.

In furtherance of this proposal, I have, as a representative of the National Canners Association, agreed to explore with executives in the canning industry the procedure indicated above, and I have outlined a plan that will be carried out for both the conference and tour of my industry. This is a pilot effort which may establish a pattern for such meetings in other industries.

In further self-analysis of the Task Committee's role--it was suggested that the scope of activities of the Committee might be extended to encompass air pollution and solid waste disposal as well as matters involving liquid wastes.

I believe that similar committees organized on a regional basis would serve a useful purpose. I believe that the results would be equally beneficial to industry and to the public planning agencies.

I recommended that the Public Health Service should invite industry to participate in long-range planning in both policy and technical phases of water quality and water pollution control.

I believe that industry ought to sponsor and support the Public Health Service in its efforts to develop technical and administrative staffs adequate in number and ability to meet the critical needs for action in pollution control planning.

I also believe that the Public Health Service should attempt to enlist the technical assistance and good will of industries producing wastes and, where circumstances permit, support research in qualified industry laboratories.

Finally, I believe that when adequate information is available, an educational program should be designed to acquaint industry with water pollution control planning, its design, objectives, and time schedule.

Let me assume that research can develop the technological procedures for treating food wastes to the point that their discharge no longer causes pollution. What about the economic burden and the competitive disadvantage of the industry plant which must provide more and more intensive treatment in order to meet more and more rigid pollution control regulations. This cost for non-productive effort cannot be added to the cost of his product in the market phase. The housewife cannot be expected to reward the producer who went the second mile in waste treatment by paying a premium for his product.

Among other needs is the important one of analyzing the effect on industry water utilization patterns of incentives for inducement of water conservation and pollution abatement programs. Assuming that the State or the Federal government would sponsor appropriate legislative measures, what would be the effect on conservation of water and prevention of pollution? Would such measures make it possible for industry to finance water-saving and pollution prevention procedures?

In my opinion, the single most effective measure for pollution abatement would be the granting to industry of special tax advantages to encourage and enable the construction, installation, and use of improved treatment processes.

In this regard and in conclusion I would like to read this statement by Senator Ribicoff in support of his bill which failed in the previous Congress:

> If we are to clean up our air and our water, a large part of the job must be done by private industry, but we simply cannot point the finger at private industry and say, 'You are causing some of the pollution. Do something about it.' We must

> frankly recognize that the purchase and installation of equipment to control pollution is a big expense, and that unlike many capital outlays that ultimately produce new profits, these costs basically serve the health and safety of the public.
>
> Therefore, there must be some public sharing with private industry of the economic impact of these expenditures.

I believe the industry agrees wholeheartedly with the philosophy of this statement.

SYMPOSIUM SUMMARY -- RESEARCH NEEDS TO IMPROVE WATER POLLUTION CONTROL PLANNING

George W. Gleeson
Dean, School of Engineering
Oregon State University
Corvallis, Oregon

At a conference of this type there is a certain advantage when a person happens to be the summarizer. Being the summarizer, he gains more from the program than anybody else because he pays particular attention to all that was said. I now have before me nine pages of notes from the various topics which were delivered today. I appreciate them all.

In an attempt to summarize a conference, I play a game. The game consists of putting down the thoughts, about a week ahead of time, which, from the program titles, I think the various speakers will generate. Then, as thoughts are generated, I see how close I have come to second-guessing them. Today I have done a reasonably satisfactory job in this connection, which means that I am either better informed in the area of water pollution control planning than I thought, or that there is unusual agreement between viewpoints. In attempting this summary, please note that the subtitle permits me to interject some remarks of my own.

I compliment those responsible for the arrangement of this program. It includes, first, the broad aspects, then the specific regional aspects of pollution control, then the role of the state and municipalities which I assume represents the public, and, finally, the role of industry in the program. I believe all segments of the pollution control problem have been covered in a rather comprehensive manner.

I proceed with the summary and say that, in connection with Mr. Krause's remarks, I conclude that long-range, long-duration planning is now going to meet certain stable objectives in a relatively permanent fashion. He regrets that he does not have a crystal ball, but because of the certain intangible factors that are involved in planning of such a magnitude, he must make use of crystal-balling. I conclude that the planning is directed toward the highest and best use of water for all of the multiple purposes served by a total watershed, or in a total region. The planning excludes brush-fire activities. It excludes fragmented approaches and eliminates any measures of expediency from consideration. I think the planning envisions the systems approach which many of us for a long time have felt is the only approach to such broad and important areas and subjects. The planning

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will not only be continuous in terms of planning itself, but also continuous in terms of evaluation as to how well the program is meeting the established objectives. The comprehensive planning involves the multiplicity of purposes, influences, agencies, disciplines, methods, and means. Accordingly, both interdisciplinary management and control are indicated. As an interjected remark, I would be very happy if Wally Towne would tell me how to administer interdisciplinary research. He is doing it as well as the interdisciplinary planning. Of all the failures that I know of on university campuses, interdisciplinary activity happens to be the most obvious. Incidentally, as long as I can suggest areas of research, I would suggest that research in the areas of management of interdisciplinary activity is one on which we could stand more light.

I appreciate Mr. Krause's first reference to the "population explosion," if you want to call it that, which is superimposed upon all other problems which we have. The demographic factors are, of course, superimposed upon the problems of water quality and control. Mr. Krause referred to the economic and financial factors, the health factors, the legal factors, and the social factors. I was much pleased with his remark about preventative planning, because I believe this is one of the areas in which immediate action is possible and necessary. He stated that objectives were never completely met. He indicated that we still have a lot to learn in certain areas regarding methods and procedures for removal of contaminants. He indicated a three-phase program or three-pronged program of planning, implementation, and operation, with a two-vector approach, one for inventory accumulation and the other for a resource economics study. He further indicated that the historical approach was perhaps ineffective in planning; that we need complete perspective; that the objectives must be firmly established, expressed in specific values even though such objectives might well be variable in location, variable in terms of user interest, and variable in terms of time. I'm more than pleased with his description of the systems analysis approach through mathematical modeling of river basins because of the complexity, as well as the many facets and aspects involved. In my opinion, the systems approach, with the best possible use of all of the available mathematical tools, may be the only way in which we can completely encompass all of the necessary information in a packaged fashion in any planning as comprehensive as river basin planning happens to be.

I refer to Mr. Towne's presentation. I was particularly interested in his discussion of thermal pollution; in his discussions of conflicts between the multiple uses of water and water quality; and, also, the over-appropriation of water rights. There is no question but what some high degree of management in a large number of fields is presently indicated, and that management and implementation of planning

will finally result. I have no question about this; I'm sure it will take place. Even at the present time, I might suggest that there is management required in the over-appropriation of water within the state, and some cleanup of the situation in which confusion exists in depth is necessary. Mr. Towne also referred to systems analysis and mathematical modeling; to the process for continuously monitoring streams for the storage and retrieval of data to which I say, "Thank Heavens!" He indicated that the Northwest is particularly lucky both in terms of the amount of water and the time at which current studies are taking place.

In reference to Mr. McNeil's presentation, I don't know whom I should compliment, but I should certainly compliment somebody or everybody involved in an organizational plan of such broad scope as the Columbia Basin Inter-Agency Committee and its related subcommittees. There is some slight indication woven through all of the remarks of all of the speakers of conflict between authority and control agencies. This will continue to be; it's inevitable. Mr. McNeil referred to the slowness in our social and political developments as compared to our technological developments, and later on in his presentation, made special points of public relations, of information dissemination to the public, and of public understanding of the problems in this field. I digress and take exception. This same remark was made by Professor Merryfield.

In conference with my associates--and I call them that--in the field of social psychology, they tell me that it will not be necessary to condition the public to the acceptance of broad programs of the subject type, either prior to or at the time of implementation. The public will not be greatly concerned with even the broader aspects of the problem, let alone the specific details; they will shortly, if they are not already, be conditioned to place the responsibility for programs of this type in the hands of those to whom that responsibility has been delegated. This rather shocks me in a way, but I am told that within the next 20 years, this conditioning, if that is the proper term, will be so firmly established that once the responsibility has been assigned to a responsible party to carry on any activity in the public interest, they will expect that the responsibility will be discharged in their behalf under optimal circumstances and with optimal results. I think I agree, or perhaps I've been brainwashed, but I'm beginning to be convinced that we have a certain level to which we can effectively disseminate information, and beyond which level the effort is rather futile because of the diffused nature of the pathways of the information among the public.

I believe the broad schedule that Mr. McNeil presented for the planning progress and the coordination of the involved agencies and

interests can produce nothing but a final result which should be compact, concise, and certainly applicable to the given region. Also, I'm quite sure that such falls within the broad framework as outlined by Mr. Krause.

I've already made reference to the sociological nature of the pollution problem as referred to by Professor Merryfield. I agree that the unenlightened public should be enlightened, but I am not sure that they're going to accept this enlightenment. I think that the State has a definite responsibility, and that the States recognize this responsibility primarily in the implementation phase of this program. The State recognizes its responsibility as a participant in the planning phase. The State level comprehension of the problem and the State level activities in this connection are overshadowed by the complexities and over-all planning for large basins. Professor Merryfield suggested, as I do, also, a review of the doctrines of use and ownership of water, particularly the riparian rights. He discussed the interrelationships of control. In this area we have need for research. The interrelationships of control systems need some study in depth. I'm not wholly in agreement when Fred defined the river management as an art. It is partially an art, but I do think it is somewhat of a science, also.

Mr. Mercer presented at the beginning of his talk the cry of the outraged conservationist and indicated that this would be heard more often in the future, and of this I'm absolutely sure. All over the country is a feeling in depth that we must at least clean up, if not effect true conservation. This feeling is becoming a conscious part of the public thinking. Mr. Mercer believes, and I believe, that industry recognizes the need for pollution control and is determined, if they have not already asked, to be included in all planning and control measures. I'm sure that his plea for economic assistance in the establishment of industrial control devices is justified. I agree with him that industry is beginning to face up to their full share of the responsibility, and we have very definite evidence, both individually and collectively, that they are doing so. That this attitude of cooperation continues, of course, would be my hope. I agree with him that the long-range projection of industrial requirements is a necessary study; that the long-range projection of potential community facilities is a necessary study; and that we are now in the third phase of considering each waste as a separate and distinct problem. Mr. Mercer identified the problems of his own industry; he asked that some preference be given to those most important; and that industry participate on a cooperative basis in research and a study of the particular problems of industry.

The municipalities as described by Mr. Morse are, as he said, inescapably tied to and dependent upon water. The municipalities have

been a part and parcel of all water use planning since the beginning because their very lifeblood depends upon it. He outlined the sources of water and the changes that take place. He discussed water shortage and attributed much of it to inadequate advanced planning. He indicated that the municipalities cannot go it alone; that they must coordinate their efforts with other agencies and join in any planning effort that is under way. He indicated that there is research needed in all aspects of water use, and I heartily agree. I will agree with his indication of public relations and public interests, and in his statement of organized communications, because he stipulated a municipal level. Actually, the public at this level is involved; they cannot help but be. However, when you magnify this interest to the national level, there are serious questions as to whether or not you can engage all of the people in an interesting fashion in planning as complicated, technically and otherwise, as the program of pollution control happens to be.

I close by just asking a few questions and leave these questions with you, not expecting an answer from anyone. My first question is: "When in the evolutionary process does an interdisciplinary program establish itself as a prime discipline?" I'm tired of talking about interdisciplinary programs when those programs have reached the status where they, of themselves, constitute a prime discipline. They may be a package of many interdisciplinary units, but some have matured to the stage where they, in themselves, are no longer interdisciplinary.

My next question: "Is it within the nature of organized man to permit semi-unstructured and mobile activities to remain outside the province of compartmentalization and fragmentation?" "In a broad program which must, because of its breadth, be somewhat unstructured, can we prevent island entities from developing which become divorced from the over-all planning activity?"

And I ask: "Is it possible to conduct large, effective interdisciplinary programs without the creation of empires?" I hope that it is and, if it is, I would then like to know what terminal facilities are involved in the planning and at what stage those terminal facilities are put in force. "What relationship will exist for the coordination of the necessary residuals of particular planning stages with the remaining implementation, operation, control, and enforcement?"